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THE GRASSLANDS OF NEW ZEALAND.

PROGRESS OF REGRASSING EXPERIMENTS ON DETERIORATED HILL COUNTRY IN WHANGAMOMONA COUNTY.*

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I. INTERIM RESULTS OF BURNING AND SOWING TRIALS: SEED MIXTURES RECOMMENDED FOR SECONDARY BURNS.

CERTAIN of the experimental sowings in Whangamomona County are now drawing to the close of their third year, and during this period a considerable amount of intensive analytical work has been done, particularly in respect to the secondary burns. In the light of this work, coupled with a fair general knowledge of hill grasslands throughout New Zealand, some fairly definite information on the regrassing of the deteriorated country may now be offered.

The broad principles of the experimental work as they appeal to the writer are—

(1) The thorough testing of all grassland species, with a view to determining the most effective and economical seed mixtures to use on both primary and secondary burns.

(2) Economic studies into the controversial point of how best to tackle the problem of breaking in secondary-growth country.

(3) Intensive analytical studies of the successional development of the grassland sward under the varying soil types and differing farm-management.

(4) Comparative analytical studies in the building-up of soil-fertility, and responses by the vegetation to modifications of habitat brought about by this means.

(5) The determination of breaking-in and maintenance costs in the farming of this type of country, and the determination of what soil types or what secondary-growth types are economically sound to bring into permanent grassland.

* For details of the experimental sowings, locations, &c., for 1925 and 1926 see last month's *Journal*, pages 73 to 83.

The programme of work is only in its initial stages, but a good deal of information has already been gleaned, and it is thought expedient to publish this in the form of the present preliminary article.

Trials of Grasses and Clovers for Secondary Burns.

On this point we have done much work during the past three years in the Taranaki back-country. An aggregate area of 312 acres of secondary growth has been burnt and sown, and a great deal of careful analytical work carried out. The details here recorded of the analyses of the turfs secured as a result of the sowings are not a matter of guesswork. The tables are compiled from the examination of some 27,500 points of ground-surface sown. Each point has been examined carefully storey by storey, and each species covering the point of ground-surface examined is recorded.

The old guesswork days of computing results are gone. The science of grassland formation and development—as with all pure science—is wrapped up in exact knowledge. It is the truth of what happens that needs recording—not what one thinks is happening, nor yet what one would like to see and to feel ought to happen. The grassland farmer of New Zealand has wasted and is still wasting thousands of pounds sterling in the sowing-down of his grasslands, whether they be for hill country or for flatter dairying-land. Areas have been sown and ploughed, and sown and ploughed, and yet no record exists of just what grasses and clovers paid their keep in those mixtures sown, and which grasses and clovers did not do so. Again, an exact study of the succession will be a measure of the habitat, and a measure of the habitat is imperative to the formulation of farm practices that will govern the economical management of pastures. The point method of pasture-analysis makes this record largely possible.

In Table 1 are given the results of analyses of a sufficient number of the plots that have been sown to afford a very accurate idea of just how each of the species has done. In the fourth column are given the average number of times the species has been recorded for every 100 points of ground-surface examined. In the sixth column is set out the age of the plot in months when these analyses were taken. With certain species it will be seen that as the sowing gets older there is a decrease in the number of times this species is recorded—in other words, its cover has decreased. With others it will be seen that there is an increase in the number of times recorded, while in others again the figure is somewhat stationary. This decrease or increase of the species is of utmost importance. Upon it is based the construction of the mixture so as to afford as good a turf as possible right from the onset, and one that will rearrange itself and maintain a sward as the habitat changes. In other words, a knowledge of the decrease and increase enables succession to be accurately forecasted and provided for by the sowing of suitable grasses.

In the seventh column is given the theoretical cost, in shillings per acre, to cover the whole of the ground-surface sown with any one species, judged on its performance in the mixtures sown. Looking down this column it will be seen just where the cheap sward-formers are. Again, in some cases it will be noted that the cost per 100 points

is becoming greater as time goes on, while in others the cost per 100 points is becoming less. In others the cost is remaining fairly stationary. Where this cost is low per 100 points the species can be regarded as economical, but where the cost is high, and remains high indefinitely, then that species must be ruled out entirely. In the case of the cheaper species gradually getting more expensive, such species to be economically sound must pay their way in the first few years, providing feed during this period while other slow-establishers are getting going. In the case of the expensively establishing species that are gradually becoming cheaper, time alone will prove whether or not their inclusion in the mixture is sound. One feels from field experience in other parts of New Zealand that certain of the slower-establishing species will prove economical and will justify their inclusion.

Table 1.—Showing the Relative Positions of the Main Grassland Species sown on Secondary-growth Burns up to the End of the Third Year of their Trial.

Species.	Amount of Seed sown per Acre.	Cost of Seed sown per Acre.	Average Number of Times recorded per 100 Points examined.	Total Number of Points examined.	Age of Turf when analysed.	Cost per 100 Points of Cover.
	lb.	s. d.			Months.	s.
Brown-top	4	14 0	35	2,500	12–34	40
	2	7 0	35	6,000	9	20
	2	7 0	25	5,000	12–23	28
	2	7 0	39	2,000	32–34	18
	1	3 6	29	2,000	18–34	12
	½	0 10½	9	5,500	15–23	9
	¼	0 10½	17	4,500	32–34	5
Crested dogstail ..	4	5 0	21	6,000	9	24
	4	5 0	14	10,000	12–23	36
	4	5 0	11	6,500	32–34	45
	6	7 6	13	4,000	18–34	58
	2	2 6	18	1,000	15	14
Cocksfoot	8	10 0	5	7,500	12–23	200
	8	10 0	2	7,000	32–34	500
	6	7 6	2	1,000	9	375
	4	5 0	2	2,000	9–15	250
	3	3 9	1	2,000	9–12	375
	2	2 6	1	1,000	9–12	250
	0	..	2	7,000	9–33	(volunteer).
Perennial rye-grass ..	6	2 6	6	6,500	12–23	42
	6	2 6	3	6,500	30–34	83
	4	1 8	7	3,500	12–18	24
	4	1 8	3	3,000	30–34	55
	2	0 10	3	6,000	9	28
	0	..	0·3	2,000	12	(volunteer).
White clover	2	4 0	12	500	18	33
	2	4 0	3	1,000	30–34	133
	1	2 0	8	6,000	14–23	25
	1	2 0	7	6,500	32–34	29
	½	1 0	4	6,000	9	25
	½	1 0	8	3,500	12–23	13
	½	1 0	6	2,000	32–34	17
	¼	0 6	5	1,000	15	10
Lotus major	1	4 0	3	1,000	12–18	133
	1	4 0	21	1,000	30–34	19
	½	2 0	0·5	6,000	9	500
	½	2 0	3	10,000	12–23	66
	½	2 0	19	8,500	30–34	11
	¼	1 0	1·5	1,000	15	66
Lotus hispidus	1	1 6	3	1,000	18–30	50
	½	0 9	1	6,000	9	75
	½	0 9	2	10,500	12–23	38
	½	0 9	1	9,000	32–34	75
	¼	0 4½	1	1,000	15	38

Table 1—continued.

Species.	Amount of Seed sown per Acre.	Cost of Seed sown per Acre.	Average Number of Times recorded per 100 Points examined.	Total Number of Points examined.	Age of Turf when analysed.	Cost per 100 Points of Cover.
	lb.	s. d.			Months.	s.
Danthonia pilosa ..	8	20 0	3	3,000	14–23	666
	8	20 0	14	4,000	32–34	143
	4	10 0	2	1,000	9	500
	4	10 0	11	500	33	91
	3	7 6	4	3,500	9–18	190
	3	7 6	11	1,000	33	70
	2	5 0	0·5	1,000	9	1,000
	1	2 6	3	6,500	9–23	83
	1	2 6	4	4,000	33–34	62
	½	1 3	0·6	1,000	9	210
	0	..	2	2,500	9–12	(volunteer).
Paspalum	8	12 0	2	2,000	12–18	600
	8	12 0	10	2,000	32–34	120
	4	6 0	0·1	1,000	9	6,000
	3	4 6	0·1	1,000	9	4,500
	2	3 0	0·1	1,000	9	3,000
	2	3 0	0·7	4,500	12–33	430
	2	3 0	3	7,500	32–34	100
	1	1 6	0·2	5,500	9–15	75
Chewings fescue.. ..	4	5 0	13	500	32	38
	2	2 6	3	500	12	83
	1	1 3	1	1,500	32–34	125
	1	1 3	1·5	1,000	12–23	83
	½	0 7½	1	7,500	12–23	63
	½	0 7½	1	6,000	32–34	63
Subterranean clover ..	1	4 0	3	1,500	18–34	133
	½	2 0	0·5	7,500	12–23	400
	½	2 0	1	8,500	32–34	200
	¼	1 0	0·4	6,000	9	250
	2 oz.	0 6	0·3	3,500	12–15	166
Poa pratensis	1	1 9	3	1,000	14–18	58
	1	1 9	2	1,500	32–34	87
	½	0 10½	0·5	6,500	14–23	175
	½	0 10½	3	6,500	23–34	29
	¼	0 5¼	2	1,000	14–15	22
	0	..	2	6,000	9–34	(volunteer).
Yarrow	1 oz.	0 3	1	8,500	9–12	25
	½ oz.	0 1½	1	9,000	14–23	12
	½ oz.	0 1½	1	9,500	30–34	13
Yorkshire fog (volunteer)	..	..	4	9,000	9–12	..
	..	..	9	9,000	12–23	..
	..	..	7	9,500	30–34	..
Suckling-clover (volunteer)	..	..	6	9,000	9–12	..
	..	..	4	9,000	14–23	..
	..	..	11	9,500	30–34	..
Sweet vernal (volunteer) ..	..	..	1	9,000	9–12	..
	..	..	1	9,000	14–23	..
	..	..	1	9,500	30–34	..

As far as the cost of 100-point cover is concerned, it will be noted that almost without exception the less seed applied the cheaper is such cover. In the case of brown-top, for example, where only ¼ lb. was included in the mixture, after three years 100-point cover costs only 5s. per acre, whereas where 2 lb. per acre was sown the cover costs 18s., and the 4 lb. seeding 40s. over the same period. This brings up an extremely important point in the formulation of grassland mixtures, particularly so for the permanent-grassland-soil type we are here considering. Apart from the early cover a quickly establishing species gives, there does seem a very important principle embodied in what may be termed the habitat spread. One seed alighting in a suitable

habitat may produce in time 100 per cent. cover to the limits of that habitat, whereas 1,000 seeds alighting on an unsuitable habitat may never establish at all, or if they do so their spread is virtually nil. Brown-top, white clover, and Lotus major are cases in point. If the habitat is suitable for the spread of these species very few plants indeed established per acre will in the course of time completely cover the ground; whereas if the habitat be unsuitable the writer firmly believes that no quantity of seed, however great, will ever form a turf of these species in such situations.

Modification of the habitat through top-dressing, spelling, &c., may influence considerably the spread of any one species, by the increase of the actual area of the habitat suitable for that species, and wherever practicable all pasture-management should be directed towards a setting-up of correct conditions, so that spread of the desirable species is made possible. Rye-grass or white clover will not spread on a danthonia habitat, neither will danthonia spread on a rye-grass or white-clover habitat.

Besides the species mentioned in Table 1, some sixty-odd additional species were included in the experimental sowings, but on these plots observational work only has been done. Without exception, however, it may be said that at the present time none of the species not included in the table is showing any promise whatever of being more successful than such species as brown-top, crested dogstail, Lotus major, Danthonia pilosa, paspalum, white clover, and rye-grass. It may be too soon, of course, for certain slowly establishing species to have made much headway, and it may be some years yet before definite information is obtained. In the meantime, however, farmers must rely on those species that are giving promise of success and the seed of which can be bought.

Conclusions regarding the Main Species included in the Experimental Sowings.

The records and performances of each species as set out in Table 1 are true for good average conditions throughout Whangamomona County. From a close study of these figures one may draw some very pertinent conclusions regarding each species in so far as the experiments have gone. It is found that the species can be classified into four definite groups, as follows:—

(1) Those species that are cheap to establish from seed sown, but which persist for a short time only, their disappearance being due almost entirely to the rapid exhaustion of plant-food represented by the ash of the burn. Persistence and spread of these species are possible only under constant manuring. Types: Perennial rye-grass and white clover.

(2) Those species that are cheap and rapid to establish from seed sown, and which persist for a considerable time, gradually weakening unless fertility is kept up somewhat by manurial top-dressing. Types: Crested dogstail and brown-top.

(3) Those species slow to establish and slow to spread from seed sown, but which ultimately form a cheap sward owing to their ability to spread both vegetatively and from seed shed. Types: Danthonia pilosa, Lotus major, and paspalum.

(4) Those species which up to the present are expensive to establish from seed sown, and which show little or no indications at present of ever becoming cheaper. Types: Cocksfoot, Poa pratensis, Lotus hispidus, and subterranean clover.

PERENNIAL RYE-GRASS.

Perennial rye-grass (*Lolium perenne*) is a very rapid establisher, and while there remains a certain amount of ash throws quite a fair amount of feed. The analyses show a comparatively cheap cover for the first year, being in this respect about equal to crested dogstail. To get, however, as high a cover figure as is shown by crested dogstail—21 points for the first nine months—about 15 lb. of seed of rye-grass would have to be included in the mixture sown. Both brown-top and crested dogstail are somewhat slower than rye-grass to establish and get going, and in view of the fact that the per-100-point cover is comparatively cheap, for the first year at least, the writer considers that perennial rye-grass should always be included in the mixtures, even though the cover is but of a temporary nature.

With regard to our Whangamomona sowings, the writer is inclined to think that a mistake has been made in keeping the rye-grass so low, particularly in the two latter years. From 6 lb. to 8 lb. per acre should be included in mixtures sown. The lasting-qualities of rye-grass on the average-quality secondary-growth-burn conditions are seen in the table. In three years it has declined to under half its original cover, and the theoretical 100-point-cover cost per acre has greatly increased. Where no rye-grass was sown a small volunteer cover is recorded.

WHITE CLOVER.

White clover (*Trifolium repens*) has proved one of the cheapest covers. For the first year it compares very favourably with any other species, and under top-dressing is likely to maintain itself well. Under strong competition with Lotus major, however, it seems to have fared very badly in certain plots during the third year (Fig. 3). In this investigation not only must one study the behaviour of the individual as a separate entity, but also its relation to the other species sown in the mixture. There is no doubt that for the first two years white clover has easily outclassed any other clover sown, although it must be admitted that frequently the volunteer growth of suckling-clover often covers more ground than does the white clover—and this at no cost to the farmer, the ground for the most part being well supplied with seed of this species. White clover when not top-dressed declines badly in the third year. In one plot at eighteen months white clover was standing at 12 points, and at the end of the third year these same sowings recorded only 3 points. On the other hand, the top-dressed plots have maintained a very cheap cover for the amount of seed sown.

The writer is not quite sure whether ½ lb. of white-clover seed per acre is enough. In the 1924 sowings 1 lb. was included in the mixtures for most plots, and one is inclined to think that this amount is preferable to ½ lb. per acre. Much, of course, depends on the habitat, and whether top-dressing can be carried on. If the soil is very fertile and there is not a great deal of competition ½ lb. of seed per acre would

soon cover, but where conditions are not so good, yet good enough for white clover to thrive moderately well, more plants per acre seem desirable to secure, for the spread under these conditions is not so great. The analyses, however, show very little difference in per-cent. cover between the ½ lb. and the 1 lb. per-acre sowings, although certainly the cover from the ½ lb. seedings for the first year is low.

The point is that white clover under fair treatment forms a cheap cover, and every effort should be made to get the optimum establishment right from the start. It is necessary to emphasize, however, on the failure of white clover under hard and infertile conditions, no matter how much seed is sown, New-Zealand-grown white-clover seed should always be sown in preference to ordinary imported white clover.

CRESTED DOGSTAIL.

Crested dogstail (*Cynosurus cristatus*) has proved to be a very good establisher on secondary burns, but the cover formed from this species is a trifle dearer than in the case of brown-top. Theoretically, 25s. per acre spent in crested dogstail would entirely cover the ground. There is, however, in crested dogstail a significant decrease to the end of the third year. The cover has declined from 21 points in the first year to 11 points in the third year, and the theoretical cost per 100 points of cover has increased from 24s. up to 45s. per acre.

However, even if crested dogstail still declines, it has earned for itself a place in all secondary-burn sowings, tiding over well that period between the going-out of the rye-grass and the coming-in of the slower establishers such as danthonia, paspalum, and Lotus major (Fig. 1). As in the case of brown-top (see later), the heavier sowings show no advantage over the 4-lb.-per-acre seedings. The 2 lb. sowings did exceptionally well, forming a cheaper per-100-point cover, and for the first fifteen months almost equalled the 4 lb. seedings. However, an insufficient number of plots containing this amount of seed were sown to enable very much trust to be placed on this figure. From 3 lb. to 4 lb. of crested-dogstail seed should be included in all secondary-burn mixtures.

BROWN-TOP.

Of all species included in these trials brown-top (*Agrostis tenuis*) has formed the best and cheapest cover. By the expenditure of from 6s. to 7s. per acre on brown-top seed one can rely, excepting on the very hardest knolls (Fig. 5), on covering approximately one-third of the entire surface sown. Theoretically, all the ground could be covered with this grass at a little over 20s. per acre. Analyses after three years show the position for brown-top to be still very sound, the cover per 100 points of vegetation becoming somewhat cheaper than in the first year (Fig. 2).

During the second year, as will be seen from Table 1, there was a slight falling-off in the percentage cover, which may be explained somewhat on the fact that the analyses for this period were spread throughout the whole year, while those of the third year were mostly done last December when everything was showing at its best. The cheapness per 100 points of the lighter seedings has already been referred to. Here, as far as ground covered is concerned, the ¼ lb.

FIG. 1. SWARD FORMED ON SECONDARY BURN AFTER TWENTY-ONE MONTHS (MIXTURE NO. 3, 1925 SOWINGS).

Crested dogstail and brown-top dominant, with Lotus major throughout just beginning to make itself felt in the mixture. Plot top-dressed in winter of 1926, fifteen months after burning and sowing. The dogstail and brown-top are here following on well after early but more or less temporary rye-grass growth.

FIG. 2. SWARD FORMED ON SECONDARY BURN AFTER THREE YEARS (MIXTURE NO. 7, 1924 SOWINGS).

Showing complete cover with brown-top and Lotus major dominant. Plot top-dressed in 1925 and 1926.

[*Photos by E. Bruce Levy.*

sowings in the second year effected approximately a quarter of the cover of the 2 lb. seedings, and in the third year there has been a marked increase. During the first year, however, the turfs formed by the ¼ lb. sowings were very weak, and even 9 points in the second year cannot be regarded as a satisfactory cover for this grass. Little gain seems to accrue from the heavier seedings on the average, although individual plots did show to an advantage over the 2 lb. seedings. For general purposes for all secondary burns 2 lb. per acre of brown-top should be included in the mixture.

LOTUS MAJOR.

Lotus major, in contradistinction to white clover, is very slow to establish, and the cover formed for the first two years is very expensive. For the first year practically no feed at all is given by this plant. In the second year it is contributing some 3 points per 100 examined, and in the third year the cover averages out in the neighbourhood of 20 points per 100. In some cases individual plots have averaged over 50 points, while several other plots come within the 30 to 40 points per 100 group (Fig. 3). In these latter plots the cost of the cover works out extremely cheaply in the third year per 100-point cover. In the first year certain plots cost approximately £25 per 100-point cover, but after the third year this cover is in the neighbourhood of a few shillings.

Lotus major seems very amenable to treatment, and hence is very susceptible to variation under the different conditions ruling. Close and continuous grazing, as against intermittent grazing and spelling, has a big influence on the development of the plant. On one area under close and continuous grazing for nearly three years Lotus major now covers 7 points, and this series has been top-dressed twice with basic slag, 3 cwt. per acre at each dressing. On the other hand, areas that have not been so closely grazed record an average of 40 points per 100. Certain plots of this series were top-dressed once, and other plots twice. Where no top-dressing has been carried out, but intermittent grazing and spelling practised, Lotus major there shows in its third year 14 points per 100.

Lotus major certainly does look like one of the most promising species for the class of hill country we are dealing with in Taranaki (Fig. 4). Its rapid increase during the third year speaks well for its future, and with reasonable handling of the country once this clover is well established it bids fair to remain there and do good work for all time. As far as the quantities per acre are concerned, the ½ lb. sowing per acre would seem to be sufficient. Lotus major is one of those species that, owing to the slowness of their establishment, must come on later from small quantities of seed sown, spreading out either vegetatively or by reseeding. Unless a slow-establishing plant can do this it must be eliminated from the mixture sown. An amount of ½ lb. of Lotus major per acre should be included in all secondary-growth mixtures where the annual rainfall is over 60 in.

DANTHONIA PILOSA.

Danthonia pilosa is extremely slow to establish, and the cover that this species gives for the first three years is most expensive. To cover the whole ground-surface in the first year, theoretically, would take

FIG. 3. LOTUS MAJOR AND BROWN-TOP DOMINANT ON THREE-YEAR-OLD SOWING ON SECONDARY BRACKEN BURN; TOP-DRESSED 1925 AND 1926.

Lotus major is here contributing well over 50 points, and dense growth formed has almost entirely eliminated white clover from this plot. Heavier stocking to control Lotus major somewhat, so that white clover may be able to persist, is desirable.

FIG. 4. LOTUS MAJOR AND BROWN-TOP, DOMINANT AFTER THREE YEARS, PENETRATING WELL INTO SMALL PATCH OF STUNTED BRACKEN THAT CAME AWAY AFTER BURN.

With a pasture growth of this nature thriving on the area the elimination of the bracken is easily accomplished. Plot top-dressed twice.

[*Photos by E. Bruce Levy.*

from £25 to £50 an acre for this seed. In the second year the cover is very little cheaper, but in the third year there is a considerable reduction in the cost. Danthonia comes within the same group as Lotus major, and, like that species, very little reliance can be placed on it as a producer for the first three years at least. Danthonia typifies very well the folly of including large quantities of seed of these slow-establishing species in the hope of getting an immediate cover. The policy with danthonia should be to include some 2 lb. to 3 lb. per acre in the mixture and then wait the necessary time for natural increase brought about by vegetative tillering and seed shed.

In the sowings of 1924 we were unfortunate in securing a rather low germinating line — about 40 per cent. In 1925 and 1926 the danthonia-seed used was of good quality, germinating in the vicinity of 80 per cent. Farmers should take every precaution in the buying of this seed, for generally there are many poor lines on the market. It was of great interest to note that on burns adjacent to old-established danthonia seedling danthonia-plants made their appearance without more seed being sown, and in the second year of the sowings young plants of danthonia could be found firmly established from seed shed the previous autumn by the one-year-old danthonia-plants (Fig. 7). This re-establishment under hard surface conditions from seed shed must be regarded as one of the most hopeful signs for the ultimate success of this species and for the betterment of that country as a whole.

There is no grass, in the writer's opinion, that can just fill the place of danthonia (Figs. 5 and 6), and to ensure its presence is to provide the best insurance policy against deterioration that the farmer could obtain. Where there is some danthonia already established on the country that is being burnt and sown the need to include the seed of this species is not nearly so urgent, but where little or none can be found some seed should certainly be included in the mixture. From 2 lb. to 3 lb. per acre of good seed should be sown.

PASPALUM.

Paspalum (*Paspalum dilatatum*) has proved even more expensive than danthonia to establish and to form a cover for the first three years. A glance at the table will show the extremely low point cover and the extremely high cost per 100 points, although at the end of the third year there has been quite a noteworthy increase in the cover in certain of the plots (Fig. 8). The behaviour of paspalum, in fact, coincides closely with that of danthonia. Neither are of much use for the first three years.

The establishment of paspalum in the Taranaki back-country is extremely fickle. On the sunny aspects this grass has established well, and as high as 22 points per 100 have been recorded in the third year on one area where the plots were situated on a sunny aspect and where the soil-fertility was moderately high. On the southerly faces, however, the average of points per 100 works out at a little over 1 point after three years, and in these cases 8 lb. of paspalum-seed per acre was included in the mixture. The hope for paspalum on these shady and colder aspects is not great. In districts farther north and

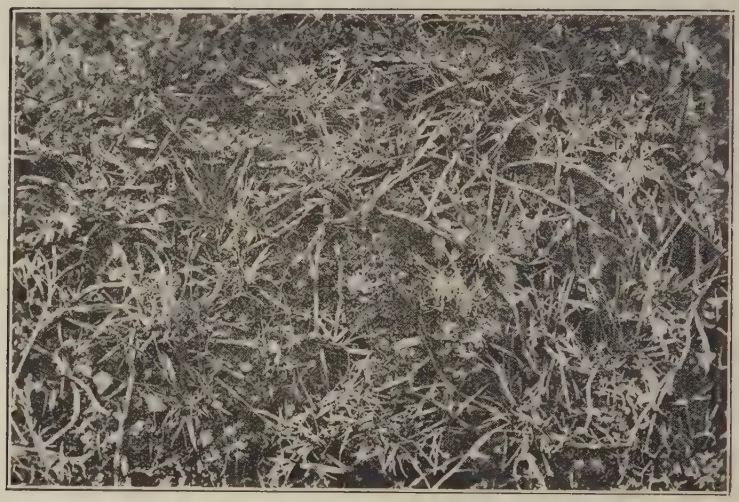

FIG. 5. HARD KNOLL ON TWO-YEAR-OLD HARD-FERN SECONDARY BURN SOWN IN 1925 (MIXTURE NO. 3), SHOWING POOR GROWTH AND VIRTUALLY NO SPREAD FROM BROWN-TOP, CRESTED DOGSTAIL, LOTUS MAJOR, ETC.

This aspect is essentially the danthonia habitat, and the writer knows no plant that will satisfactorily grass such a spot excepting Danthonia pilosa. Cost of altering appreciably such a habitat by manuring would be in the vicinity of £3 an acre.

FIG. 6. DANTHONIA PILOSA WELL ESTABLISHED AND TILLERING OUT SPLENDIDLY ON A HABITAT EXACTLY SIMILAR TO THAT SHOWN IN FIG. 5.

Mixture sown here (No. 4, 1925 sowing) contained 3 lb. danthonia (germination 80 per cent.), otherwise mixture identical to that sown and illustrated in Fig. 5.

[*Photos by E. Bruce Levy.*

warmer than Whangamomona paspalum should show up much better, and in such places, and also on the warmer sunny faces throughout the Taranaki back-country, about 2 lb. of paspalum-seed per acre should be included in the mixture.

CHEWINGS FESCUE.

Chewings fescue (*Festuca rubra* var. *fallax*) is fairly rapid to establish, and the seed being fairly cheap makes the use of this grass enticing. It does not compare with brown-top, however, as an early establisher, and as a permanent grass it does not compare favourably with Danthonia pilosa. In certain of the very hard sandstone faces that are too poor for brown-top the inclusion of Chewings fescue in the mixture may be warranted. Its showing in the plots certainly compares more favourably at the present time than either paspalum or danthonia, and perhaps it is still a little early to condemn this grass as far as the Taranaki back-country is concerned. One thing seems fairly definite: a small quantity of seed in the mixture is of little value, as the spread of any one plant is slow, and when it comes to the inclusion of larger amounts—say, 4 lb. to 6 lb. per acre—it is just doubtful whether that money would not be better spent on certain other species. Certainly one should not include Chewings fescue to the exclusion of either brown-top or danthonia.

COCKSFOOT.

Cocksfoot (*Dactylis glomerata*) has proved to be almost a complete failure on secondary burns. It is just about ten times as expensive to establish and to form a cover as brown-top or crested dogstail, and to the end of the third year shows no improvement, but rather a decline. In the first year, theoretically, it would cost £10 an acre to cover all the ground with cocksfoot, and at the end of the third year this cover cost has increased to £25 per acre. Compare this with the £1 an acre in the case of brown-top, or even with the £2 5s. per acre cover of crested dogstail, after the three years.

It will be noted that after three years cocksfoot is recorded as 2 points per 100 points examined, and in these plots 8 lb. (or 10s. worth) of seed per acre was included in the mixtures. One may refer now to the plots analysed, sown at the same time, but where no cocksfoot-seed was included in the mixture. Here we record also 2 points of cocksfoot per 100 points examined. The significance of this calls for some comment. The cocksfoot showing where none had been sown is the vestiges of old cocksfoot-plants that have withstood the burning, or which came up as volunteers from seed shed from old-established plants persisting in the secondary growth before burning. It appears to the writer as though this percentage cover represents approximately the per-cent. cocksfoot habitat, and if this is so it matters not how much seed is sown; unless the habitat is modified, sooner or later cocksfoot will readjust itself to this 2-per-cent. cover, that being a measure of the 2-per-cent. cocksfoot habitat.

The writer has frequently stressed this habitat influence on the different grassland species, and the more the question is studied the more and more is he convinced that each grassland species has a definite habitat or set of conditions that must be provided before that particular species

FIG. 7. HARD FACE ON A TWO-YEAR-OLD SECONDARY BURN WHERE MOST OF THE GRASSES SOWN HAVE FAILED TO TAKE.

The two small plants marked × are seedling Danthonia pilosa successfully established from seed shed by one-year-old danthonia-plants grown from seed sown in 1925 (mixture No. 4). Importance of such re-establishment cannot be overestimated.

FIG. 8. THREE-YEAR-OLD SWARD FORMED BY SOWING ON SECONDARY BURN.

Brown-top dominant, with fair sprinkling of Lotus major and crested dogstail throughout. The broad-leaved grass towards right of photo is paspalum; 2 lb. was included in mixture, and on this area at thirty-one months 4 points per 100 of paspalum were recorded. Plot top-dressed 1925 and 1926.

[*Photos by E. Bruce Levy.*

will thrive. The economics of this consideration must be apparent to all, and the task of measuring grassland habitats so as to avoid waste in seeding becomes more and more pressing. The records given for cocksfoot under the average conditions of Whangamomona County show very clearly indeed that unless the farmer can considerably modify the soil-conditions of his hillsides by constant top-dressing and by careful manipulation of his stock it is quite useless to include any cocksfoot in the secondary burns sown. In fairness to cocksfoot it must be added that the seed used for the first two years was Danish. Last year Akaroa seed was largely used, but analyses so far show no noticeable improvement.

POA PRATENSIS.

Poa pratensis is a grass that seems to require fairly fertile conditions to establish satisfactorily from seed. When sown on the primary burn one gets fairly good establishment, and such plants will persist almost indefinitely—but as mere vestiges wherever conditions remain hard. Throughout the secondary-growth country there is a small amount of Poa pratensis persisting. When, however, it comes to the question of including more seed in the secondary-burn mixture very little hope can be held out for much additional establishment of this grass. In the records for Poa pratensis in Table 1 it will be noted that its volunteer growth (no seed of Poa pratensis being included in some mixtures) is equal in amount to that of those plots where upwards of 1 lb. of seed per acre was sown. Here, then, one has a parallel case to cocksfoot where habitat conditions permit only a certain per-cent. cover; and here again the writer fully believes that if 20 lb. or more of Poa-pratensis seed per acre had been sown not more than the 3 point per 100 points of cover would have resulted. For secondary burns, therefore, the inclusion of Poa pratensis in the mixture is not advised.

LOTUS HISPIDUS.

Lotus hispidus has failed almost completely to do much good up to the present. Although the seed of this clover is much cheaper per pound than that of Lotus major, the cover formed is very much dearer in the third year. In their efforts to get Lotus major established many farmers sowing secondary-growth burns prefer to sow the mixed Lotus hispidus and Lotus major seed because of the much lower price asked for this mixture than for the Lotus major pure. It will be seen from the performances of these two species that after three years sown the Lotus major, on the average, is about four times as cheap as Lotus hispidus.

The writer feels certain that by these comparative analyses of turfs we shall all learn to judge any seed we include in mixtures not by its price per pound of seed, but by its performance in the field after a number of years' trial. There are many species and strains of various seeds on the market, varying greatly in price, and at the present time it must be admitted that one does not know whether Hawke's Bay rye-grass at 14s. a bushel is dearer or cheaper than, say, Southern rye-grass at 8s. a bushel. It is only after careful analytical work over a period of years and on all grassland habitats that the most economical sowings can be prescribed.

Lotus hispidus may, of course, yet improve its position in the sowings made, but until this improvement is manifest its inclusion in mixtures cannot be recommended for the back Taranaki class of country.

SUBTERRANEAN CLOVER.

When starting out on this work we certainly had hopes of subterranean clover (*Trifolium subterraneum*). From seed the plant is extremely rapid to establish, and the early spring growth is most acceptable; but, unfortunately, the early promise of this clover has not been entirely fulfilled. A glance at the table shows an extremely expensive cover for the three years the plots have been in progress. Certainly for the third year there does seem to be a slight improvement

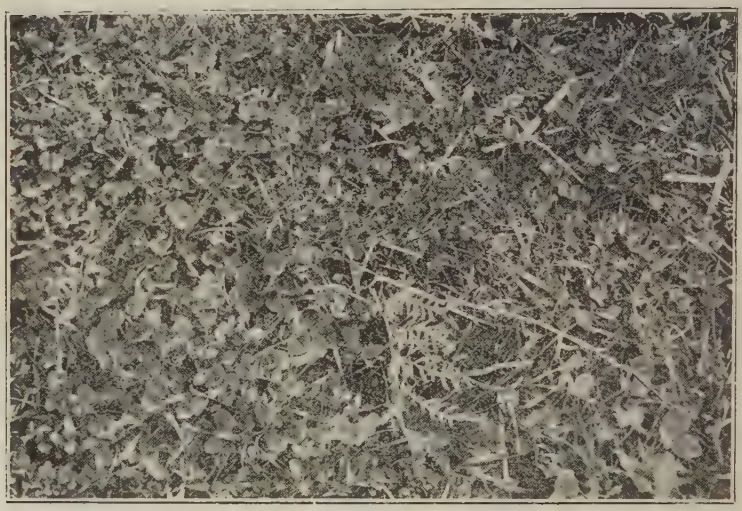

FIG. 9. SUBTERRANEAN CLOVER (LOWER LEFT OF PHOTO) PERSISTING SOMEWHAT STRONGLY ON THREE-YEAR-OLD SECONDARY BURN THAT HAS BEEN TWICE TOP-DRESSED.

This area was rotationally grazed and every chance given for subterranean clover to develop. Analyses when photo taken at thirty-one months show subterranean clover contributing 4 points per 100; 1 lb. of the seed was included in mixture.

[*Photo by E. Bruce Levy.*

(Fig. 9), but when this is compared to the cover formed by Lotus major or white clover one must say definitely that subterranean clover is a very expensive species for the first three years at least. It is, however, too early yet to condemn this clover. A comparatively small quantity of seed only has been used, and the seed is very large in comparison to white clover and Lotus major. Birds, also, are destructive of the seedlings, so that taken all in all very few plants per acre became established, and spread from these may be a matter of some years.

Subterranean clover, then, comes into the third class of pasture species, and its economic use is along the lines of including a very small amount in the mixture and waiting for its increase by voluntary reseeding. If the increase does not come after a certain number of years, then subterranean clover must be deleted from our list of useful species. Farmers desiring to give this clover a trial would be wise to include not more than $\frac{1}{4}$ lb. of seed per acre, and on no consideration should preference be given to it before white clover or Lotus major.

YARROW.

Yarrow (*Achillea millefolium*) was included in almost all our mixtures, but in very small quantities. From this few pence worth of seed, however, as many points of vegetation have been secured as from the many shillings spent in the case of subterranean clover. On a theoretical basis per 100 points of vegetation yarrow is very cheap to establish, but whether the plant is of much use once it is established is a debatable point. However, one must be prepared to welcome anything in the form of a cheap feed for much of the country being dealt with. The small quantity that we have been using, however, is hardly giving this plant a fair test. It would appear that more seed should be used or the species deleted from the mixture altogether. In our pure sowings in 1926 5 lb. per acre was sown, and when these plots have been going a few years one will be in a better position to know what should be done in regard to this species.

SUCKLING-CLOVER.

Suckling-clover (*Trifolium dubium*) has not been sown on any of the plots. This is not because we do not appreciate its importance, but because the plant is natural to the country, and a big volunteer growth (equivalent to the take one might expect to get from the sowing of many pounds of the seed per acre) is general over most of the areas burnt. Were it not for this volunteer growth one would certainly advise the inclusion of this clover in the mixture. Over many of the plots that have been top-dressed perhaps the greatest response of any species is made by suckling-clover, and in the initial manurial top-dressing of old worn-out turfs it is the response of this clover that largely justifies the expenditure on the top-dressing for the first year or so, until the white clover is sufficiently strengthened to carry on.

YORKSHIRE FOG.

Yorkshire fog (*Holcus lanatus*) has not been sown as a regular constituent of the mixtures, but quite a large volunteer growth has made its appearance from seed lying dormant within the secondary growth. The average figures given in Table 1 for the three years are really very significant and represent a cover not to be despised, particularly when the cover is secured for nothing. Whether or not this cover could be increased by the sowing of more seed is a moot point, and one feels that when it comes to paying for a Yorkshire-fog cover one is more inclined to put that money into the seed of some other species that has a better feeding-quality. Whether this course is sound, however, the writer would not like to say at present.

SWEET VERNAL.

Sweet vernal (*Anthoxanthum odoratum*) is general over most of the country as a volunteer, but, as will be seen from the analyses, the average percentage cover is low—much lower really than what one would expect. On the poorer and harder country, particularly that which is quite run out, there is often a very marked volunteer growth of sweet vernal. On Mr. A. Bottomley's farm at Whangamomona, for example, the volunteer growth for the second year was 17 points, and 15 points in the third year. On this place the take of the regular grasses sown was extremely bad, and the writer is very much inclined to the opinion that a large sweet-vernal volunteer growth, particularly when the growth is sparse and the plants stunted, is a fairly certain indication that the fertility is very low and that it is useless to expect much else than danthonia to do well on that country. This, however, does not at all hold true where the sweet vernal is growing vigorously.

These volunteer growths, as pointed out elsewhere in this article, are extremely valuable, and the ultimate economic control of secondary growth is largely wrapped up in establishing additional species that will return as volunteers on the burning-off or on the crushing-out of that country, as often as it is necessary to finally kill the secondary growth outright.

Seed Mixtures for Secondary Burns.

The following mixtures, based on present-day knowledge, are recommended for secondary-growth country :—

(1) *Good general secondary-burn mixture for all hill country having over 60 in. rainfall.*

	lb.
Brown-top	2
Crested dogstail	4
Perennial rye-grass	6
White clover	1
Lotus major	½
Danthonia pilosa	3
Total per acre	16½

Cost per acre approximately 26s.

(2) *Secondary-burn mixture for hill country having over 60 in. rainfall where efficiency of mixture is slightly sacrificed to reduce cost.*

	lb.
Brown-top	2
Crested dogstail	3
Perennial rye-grass	6
White clover	½
Lotus major	½
Danthonia pilosa	2
Total per acre	14

Cost per acre approximately 20s.

(3) *Secondary-burn mixture where likelihood of paspalum proving a success.*

	lb.
Brown-top	2
Crested dogstail	3
Perennial rye-grass	6
White clover	½
Lotus major	½
Danthonia pilosa	2
Paspalum	2
Total per acre	16

Cost per acre approximately 24s.

(4) *Secondary-burn mixture where rainfall is below 60 in.*

	lb.
Brown-top	1
Crested dogstail	4
Perennial rye-grass	6
White clover	1
Danthonia pilosa	4
Total per acre	16

Cost per acre approximately 22s. 6d.

The costs of these mixtures are based on last season's prices, which are considerably in excess of those likely to be charged this year.

Mixture No. 1 will probably give the most satisfactory results, but the cost is a little above what the average farmer feels inclined to pay. No. 2 mixture will also give good results, and the cost of this mixture should be within the reach of any farmer setting out to break in secondary-growth country. Wherever possible the farmer should save certain seeds that are of use in his sowings. This is especially to be desired in the case of danthonia, and where he can procure danthonia-seed in this way it is sound practice to increase the amount used. In no case should any of the ingredients recommended be cut down below the amounts as given for mixture No. 2, and under no consideration should any of the species be omitted and replaced by what the farmer may consider to be cheaper species. It should be remembered always that on hill country of the type here dealt with the cheapest seeds one can buy for the secondary-growth burn are brown-top, crested dogstail, white clover, and, in the third year, Lotus major. Perennial rye-grass is cheap for the first year, but then becomes rapidly dearer. Danthonia, although its seed is dear, is absolutely essential for carrying on the pasture on poor locations after the third year, and the writer feels confident that as time goes on this seed will turn out infinitely cheap.

On the warmer country where there is any chance at all of paspalum thriving mixture No. 3 should be sown. In districts that are comparatively dry—say, under 60 in. of rain—Lotus major is not at all likely to succeed, and brown-top will not thrive very well. In this case mixture No. 4 is recommended for the secondary burn.

These mixtures may be regarded as the most economical ones the farmer could sow. There are certain other species which might be added, and where the farmer feels like investing a few shillings more per acre on his country any one of the following may be added: ¼ lb. subterranean clover, ½ lb. Lotus hispidus, 3 lb. Chewings fescue, 2 oz. yarrow; and on strong papa or limestone country ½ lb. Poa pratensis and 4 lb. cocksfoot. With any one of these latter species, however, it is a gamble whether the money spent will ever be recouped. In the case of Danthonia pilosa prescribed in any one of the mixtures it should be clearly understood that where this grass is already well established on the country being burnt no more of the seed need be included in the sowing.

Time for Burning and Sowing.

Secondary growth should be burnt in the autumn, towards the latter end of March for preference, and the seed sown as soon after the burn as possible. If it can be sown while the ash is still warm, so much the better. In 1925 certain of our experimental sowings were made on areas burnt in the beginning of February of that year and not sown until the end of March. Volunteer growth of catsear, Scotch thistle, sweet vernal, Yorkshire fog, hawkweed, and suckling-clover was making its appearance at the time of sowing. The seed sown established poorly and very slowly, so that winter and cold weather came on before the seedlings were firmly established. Despite the fact that top-dressing of certain of these plots was carried out in the winter following the

burn, it was not until the following spring that any appreciable growth was made. On areas not top-dressed, burnt early in February and sown late in March, the growth has remained poor since the sowing, and it is highly doubtful whether more than one-tenth of the seed sown paid for its inclusion in the mixture.

For the more or less temporary elements in the mixture, at least, rapid establishment is imperative if the money spent in these is to be soundly invested. It seems evident that when one is spending money where the chances of loss are exceedingl great the utmost care should be taken to apply that money at the most opportune moment. Late sowings (after the middle of April) and sowings made on areas burnt months before the seeding takes place prejudice the chances of success. The seed one applies means money, and to waste money through spending at the wrong time is economically criminal. Early autumn burns are frequently a success, particularly so in the wet climate of the Taranaki back-country, but additional care must be taken to control the return of bracken. The writer does not advocate spring burning wherever any sowing is to be done, although frequently where one can concentrate stock to control the returning bracken success can be obtained. When dealing with hard fern, however, the spring burn is of no use. Certainly when the fronds are dead, killed by winter frosts, it is very tempting to burn this growth off ; but at this time the ground is still damp and the fire is never sufficiently hot to roast the overground rhizomes, and consequently in a couple of years' time the hard fern is as bad as ever. In the late autumn, when the ground is dry, a good hot fire will kill most of the rhizomes. However, it does seem imperative —whether an area is burnt in the spring or early autumn—to get the seed on right away.

Burning to control secondary growth where a sufficiently satisfactory volunteer growth comes away after the burn, so that no further seeding is necessary, is a different matter to when sowing is being done. Once the necessary volunteers are present—that is, danthonia, paspalum, brown-top, or Lotus major established and lingering in the secondary growth—the best advice then is to burn whenever any possible chance occurs.

(To be continued.)

Classification of Pigs.—The number of pigs in the Dominion at the 1926 enumeration (including boroughs) was 472,534, an increase of 32,419 on the preceding year. The total was made up as follows : Pigs under one year old, 364,962 ; breeding-boars one year and over, 12,510 ; breeding-sows one year and over, 63,702 ; other pigs, 31,360.

Area of Orchards, Market Gardens, &c.—The official agricultural statistics for 1925–26 give the following particulars of this class of holdings in New Zealand : Commercial orchards (bearing, 19,876 acres ; not bearing, 1,937 acres), 21,813 acres ; private orchards, 5,255 acres ; market gardens (excluding potatoes on ¼ acre and over), 4,599 acres ; nurseries and seed-gardens, 505 acres ; vineyards, 261 acres. Private orchards, for the purpose of the statistics, consist chiefly of small areas the produce of which is consumed principally on the holding, or, if sold, does not aggregate an annual value of £50.

MANURING OF EARLY POTATOES.

EXPERIMENTS IN AUCKLAND PROVINCE, 1926.

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THE growing of early potatoes is a feature of farming in certain districts in the Auckland Province. Free-working loams of good quality, combined with freedom from damaging frosts, are the natural factors favouring success. Though the yield of the early crop is comparatively light (from 5 to 6 tons per acre being considered quite satisfactory), the manuring is heavy, and the growers claim that very liberal manuring pays because of the high prices secured for the earliest "new" potatoes. Two crops and a crop of "seed" are taken in one season from the same ground. The residue of the manure from the early crop assists the main crop which follows.

Official statistics for 1925–26 show that an area of 2,900 acres was sown in potatoes in the Auckland and North Auckland Land Districts. As the information is collected in September of each year this area —which only includes areas of 1 acre or more—takes in all the crops intended for the early market as well as those to be sown for the main crop.

The usual rotation is potatoes after grass two or three years old. Some of the more progressive growers include a crop like mustard, which is ploughed in; it adds organic matter and assists drainage—a consideration of importance in the wet winters. Other cash crops, such as onions, mangolds, and carrots, are also grown.

The very early crops are generally taken, as stated, from favoured districts where the soil is a suitable free-working loam, and where frosts which do any damage rarely occur. The higher lands (which are high-priced) of Franklin County fall into this category. "The Hill" at Pukekohe is best known, and is one of the favoured places where potatoes are grown for the very early market, the crop coming in sometimes during the first week of September. The earliest consignments are sent to Wellington, and even to the South Island, where the wholesale price realized is 4d. to 5d. per pound. When the market weakens in the South, which usually occurs about early October, the potatoes are put on the Auckland market and are sold at 2d. to 3d. per pound. When the price goes down to 1½d. a pound or a little less the growers usually reduce supplies until the price advances. Last season 8,000 tons of potatoes were sent from Pukekohe, representing £72,000 in value. This season it is estimated that 9,000 tons will be trucked by 31st March.* Other districts which supply early potatoes are Kerikeri (Bay of Islands), Whangarei, Helensville, Avondale, the Waitakeres, Onehunga, Mangere, Papatoetoe, Papakura, Waiuku, and Taupiri. With a few exceptions, the potatoes are grown on volcanic soil. A factor which helps the grower with his early crop in these districts is that he has not the competition of growers in the South.

* Figures supplied by Mr. A. E. Lovell, Railway Stationmaster, Pukekohe.

The demand for early potatoes is increasing with the increase in population, and new districts are coming into the early-potato industry. These districts encounter less disease than the older places, and the new ground gives a better sample, as the shape comes back because of the greater vigour in the tuber.

Manuring of the early-potato crops in the older districts has undergone a great change from thirty years ago, when, and until recent years, a ton of bonedust per acre was the usual dressing. The increase in price of bonedust, together with the results of experiments in manuring, have been the chief factors in altering the manural prescription. Thirty years ago, when the early-potato industry was in its infancy in the province, bonedust was sold in Auckland at £5 12s. 6d. per ton; in 1914 the price was £8; to-day it is about £12. In 1922 it was higher still—in fact, it was quoted in Auckland at £23 a ton after the war, when all manures were scarce.

High prices directed attention to other fertilizers, such as the lower-priced phosphates, including superphosphate and ground raw rock. From a record recently made of twenty-two growers in the Pukekohe district it was found that fifteen used a mixture of super and bonedust, two used bonedust alone, and the remainder used proprietary manures. The average dressing per acre of growers using bonedust and super was 5 cwt. of super and 11 cwt. of bonedust. An average dressing of 1½ cwt. of sulphate of potash was used in every case. It will be seen that for years bonedust was the only manure added, and although its increased price lead to the inclusion of super, large quantities of bonedust still formed the chief phosphatic dressing.

Scheme of the Experiments.

The aim of the experiments here recorded, established at Pukekohe, Taupiri, and Kerikeri, was to see how far a less costly phosphate could economically replace all or part of the bonedust. The mixtures used were as follows:—

	Per Acre.
(1) Bonedust	15 cwt.
Sulphate of potash	2 cwt.

	Per Acre.		Per Acre.
(2) Bonedust	7½ cwt.	(3) Superphosphate (44–46)	7½ cwt.
Superphosphate (44–46)	7½ cwt.	Ephos phosphate	7½ cwt.
Sulphate of ammonia	1⅝ cwt.	Sulphate of ammonia	3¼ cwt.
Sulphate of potash	2 cwt.	Sulphate of potash	2 cwt.

It will be seen that the amounts of phosphatic fertilizers were kept constant, but were different in type. In No. 2 mixture half the bonedust has been replaced by superphosphate, and in No. 3 all the bonedust has been replaced by a mixture of super and Ephos. The bonedust used was a locally manufactured green-bone product which is popular with the growers at Pukekohe; its analysis was 48·32 per cent. tricalcic phosphate, and 4·2 per cent. nitrogen. An equivalent amount of nitrogen was substituted where bonedust had been replaced by the addition of sulphate of ammonia. The amounts of nitrogen and potash were therefore kept constant in all the mixtures.

Each plot consisted of three rows of potatoes 28 in. apart, and was adjacent to a plot of different treatment. This series was continued several times across the field. When dug all the rows were weighed,

but only the weight of the middle row of each plot was taken for comparison. At all three locations cut sets of the "Gamekeeper" variety were used for seed, being planted by hand and ploughed in, the manure having previously been weighed out and applied along the face of the furrow.

Trial on Farm of E. J. Campbell, Pukekohe.

In this experiment sowing was done on 21st and 22nd June, and weighings made on 8th, 9th, and 10th November, 1926. The field selected for the experiment, although not having sufficient altitude to produce the earliest of crops, consists of a good friable volcanic loam typical of Pukekohe Hill. It had been in grass for many years, and there was a splendid sole previous to ploughing, providing a good supply of organic matter for the crop. The importance of this humus supply probably had a direct bearing on the result, as will be seen later. The rows were 7 chains long, and the series of plots were repeated six times across the field, so that each treatment was compared with another forty-two times when weighings were made at every chain.

Observations during Growth.—From the time the plants appeared above ground until digging, the super and Ephos plots, and to a lesser extent the super and bonedust plots, appeared to be ahead of the bonedust. This fact was noticed by several observers during the growth period. The haulms of the super plots ripened off quicker, and it may be safely maintained that the inclusion of super in the mixtures has been conducive to an earlier ripening. This is a most important consideration in the growing of early potatoes, since a gain of two or three days at digging-time may mean the difference of 1d. or more per pound in some seasons.

GENERAL VIEW OF THE EXPERIMENTAL PLOTS AT MR. CAMPBELL'S FARM, PUKEKOHE, TAKEN AT TIME OF DIGGING.

Basis of Comparisons.—All the rows were dug separately by hand and the tubers graded into marketable and small. At that time of the year potatoes were quoted at £12 per ton, which is a figure well below that ruling in recent years at the same period. In Table 1 and subsequent tables no value has been placed on the small unsaleable potatoes, since these are usually kept by the diggers.

The comparisons in all the tables have been worked out by "Student's" statistical method, under which a difference is regarded as significant when the chances are 30 to 1 or more in its favour.

Table 1.—Summary of Results at Pukekohe.

Type of Phosphate.	Yield per Acre.		Cost of Manures per Acre.	Value of Increase per Acre.	Profit per Acre.	Difference significant (S.) or non-significant (N.S.).
	Table.	Small.*				
	Tons cwt.	Cwt.	£ s. d.	£ s. d.	£ s. d.	
15 cwt. super and bonedust	6 6·8	8·75	9 12 5			
15 cwt. bonedust ..	5 14·4	7·50	10 10 0			
In favour of super and bonedust	12·4	1·25	..	6 4 0	7 1 7	S.
15 cwt. super and Ephos	6 9·0	7·25	8 18 9			
15 cwt. bonedust ..	5 13·4	7·50	10 10 0			
In favour of super and Ephos	15·6	..	..	7 16 0	9 7 3	S.
15 cwt. super and Ephos	6 9·0	9·0	8 18 9			
15 cwt. super and bonedust	6 6·8	9·2	9 12 5			
In favour of super and Ephos	2·2	..	..	1 2 0	1 15 8	N.S.

* Yield of small potatoes not treated statistically.

COMMENTS ON TABLE I.

(1) Super and Ephos *versus* bonedust: The substitution of mineral phosphates has resulted in an increase of over 15½ cwt. of saleable potatoes, besides lessening the cost of manuring. Allowing £10 as the net value per ton after deducting the cost of digging and carting (£2 per ton), and adding the difference in the cost of manures, the profit derived has amounted to £9 7s. 3d. per acre.

(2) Super and bonedust *versus* bonedust: Here again the increase is appreciable, and the gain by substituting super for half the bonedust amounts to £7 1s. 7d. per acre.

(3) Super and Ephos *versus* super and bonedust: When these two are compared with one another there is a difference of 22 cwt. in favour of super and Ephos, representing a gain of £1 15s. 8d. per acre. This, however, is not significant when taken statistically.

The cost of manures taken in the above calculations was based on the prices ruling at the time of planting. The recent reductions in the price of superphosphate would show a still greater gain in the superphosphate mixtures.

Bonedust still has many adherents by reason of its "lasting" qualities or residual effects. One has often heard it said that "it is so good for the grassland afterwards." But a pound in the hand is probably worth more than two in the ground in these days when the slogan of "quick returns" is being increasingly applied to agriculture. What residual value would compensate for a cash increase of £9 per acre as in the case of super and Ephos, or £7 as in the case of super and bonedust? From our experiments in pasture top-dressing at Pukekohe it would pay better to spend money on 3 cwt. per acre of a suitable phosphate than depend on the residue of bonedust. An attempt is being made at Pukekohe and Taupiri to test the residual effect of the manures used in these experiments, and the results of this investigation will be published at a later date.

Trial on Farm of A. Wright, Kerikeri.

The Kerikeri district, Bay of Islands, has only recently been connected with the early-potato industry, but the mildness of its winter and its freedom from frosts make it ideally suited for that purpose as far as climate is concerned. The soil here is volcanic, of a pebbly ironstone nature, lighter than the Pukekohe soil, but lacking in humus. The only area available sloped in two directions, and thus running the rows across a slope was unavoidable. The field was previously in grass, but the turf was very poor, consisting mainly of Chewings fescue and danthonia. Consequently there was little addition of humus to the soil after ploughing.

Sowing was done on 12th and 13th May, and the crop was dug on 4th and 5th October, 1926. The rows were 5 chains long, and the series was replicated four times across the field so that twenty comparisons could be made.

Observations during Growth.—There was no appreciable difference between the individual rows at any time, except that those running along the foot of the slope looked better, and in fact weighed out better, than those at the top, a result obviously due to better fertility.

Comparisons of Yield.—All the rows were dug by hand and sorted into grade 1, grade 2, and small sizes, each grade being weighed separately. The price obtained for the first grade was 3d. per pound, and for second grade 1d. per pound, in the Auckland market. Particulars of results are set out in Table 2 (next page).

COMMENTS ON TABLE 2.

Super and bonedust *versus* bonedust: The combination of super and bonedust has at this centre shown its superiority over the other mixtures, and has given an increase of more than 10 cwt. over bonedust alone. This increase is valued at £12 10s., giving a profit of £13 5s. 9d. when compared, after allowing £2 per ton for digging and £2 10s. per ton for carting and freight to Auckland. The manures have been valued at the ruling price at planting, plus freight from Auckland.

Super and bonedust *versus* super and Ephos: The difference here has been remarkable, and the position as at Pukekohe entirely reversed. The super and bonedust gave an increase of over 19 cwt. of saleable potatoes when compared with super and Ephos. The profit derived

by using the former mixture amounts to £22 13s. 9d., a very large figure, magnified, no doubt, by the high price obtained for the produce.

Super and Ephos *versus* bonedust: The bonedust gave an increase in grade potatoes of 3 cwt. 81 lb., but this increase was counterbalanced by an increase of over 3 cwt. of second grade in favour of the super and Ephos. These results, however, are not significant when treated statistically, so that no reliance can be placed on them.

Table 2.—Summary of Results at Kerikeri.

Type of Phosphate.	Yield per Acre of Saleable Potatoes.				Cost of Manures per Acre.	Value of Increase per Acre.	Profit per Acre.
	First Grade.	Second Grade.	Total.	Small.			
	Tons cwt. lb.	Tons cwt. lb.	Tons cwt. lb.	Cwt. lb.	£ s. d.	£ s. d.	£ s. d.
15 cwt. super and bonedust	4 3 43	1 1 28	5 4 71	6 84	10 15 6		
15 cwt. bonedust	3 13 31	1 0 84	4 14 3	5 70	11 11 3		
In favour of super and bonedust	0 10 12	0 0 56	0 10 78	1 14	..	12 10 0	13 5 9
	S.	N.S.	S.				
15 cwt. bonedust	3 8 25	0 17 77	4 5 102	5 6	11 11 3		
15 cwt. super and Ephos	3 4 56	1 1 0	4 5 56	6 0	10 3 9		
In favour of bonedust	0 3 81	..	0 0 46	..	..	3 15 0	2 7 6
In favour of super and Ephos	..	0 3 35	..	0 106			
	N.S.	N.S.	N.S.				
15 cwt. super and bonedust	4 3 43	1 1 28	5 4 71	6 84	10 15 6		
15 cwt. super and Ephos	3 4 56	1 1 0	4 5 56	6 0	10 3 9		
In favour of super and bonedust	0 18 99	0 0 28	0 19 15	0 84	..	23 5 6	22 13 9
	S.	N.S.	S.				

S. = Significant difference; N.S. = Non-significant difference.

NECESSITY OF ORGANIC MATTER.

The results at Kerikeri for the past season go to show that superphosphate can replace bonedust to a certain extent, but that under similar conditions bonedust cannot wholly be replaced. The explanation of this probably lies in the poor supply of humus in the Kerikeri soil. It has been repeatedly proved in the past that for yield the potato crop must have a good supply of organic matter to be a success. In Great Britain and on the Continent of Europe this demand is satisfied by a large application of farmyard manure. Up to 15 tons of farmyard manure per acre are applied, together with artificials. In fact, the conclusions arrived at by Hall after twenty-six years of manuring potatoes at Rothamsted are that the best

basis for the growth of potatoes is a supply of well-rotted farmyard manure. He goes on to state that in the absence of farmyard manure it should be replaced by some manure containing organic nitrogen. Now, while it is almost impossible in this country to make such an application of farmyard manure, the ploughing-in of a green crop or the turning-under of a good grass turf goes a long way towards supplying the potato crop with the necessary organic material.

At Pukekohe this object was attained, and the substitution of mineral fertilizers was highly successful. The supply of organic matter at Kerikeri was limited, consequently that same success with entirely mineral fertilizers has not been forthcoming.

Trial on Farm of S. V. Bilkey, Taupiri.

The soil at Taupiri is slightly heavier than the Pukekohe soil, and it varies to a certain extent. The area selected was formerly in grass, which was not of good quality, being largely composed of the twitches, but the soil itself was not lacking in organic matter.

Sowing was done on 30th June, and the crop was dug on 22nd and 23rd November, 1926. The rows were 4 chains long, but the series was replicated five times so that twenty comparisons could be made.

Observations during Growth.—As at Pukekohe, the super and Ephos plots went ahead soon after the plants were above ground, but this superiority was not maintained later in the season. The soil at one side of the area was heavier than the rest, and during the winter became very sticky. It was noticed when digging the crop that here the bonedust gave much better yields.

Table 3.—Summary of Results at Taupiri.

Type of Phosphate.	Yield per Acre.			Cost of Manures per Acre.	Value of Increase per Acre.	Profit per Acre.
	Table.	Seed.	Total.			
	Tons cwt. lb.	Tons cwt. lb.	Tons cwt. lb.	£ s. d.	£ s. d.	£ s. d.
15 cwt. super and bonedust	4 8 49	1 11 0	5 19 49	9 12 5		
15 cwt. bonedust ..	4 3 43	1 6 0	5 9 43	10 10 0		
In favour of super and bonedust	0 5 6	0 5 0	0 10 6	..	6 0 8	6 18 3
	N.S.	N.S.	N.S.			
15 cwt. super and Ephos	4 16 2	1 9 68	6 5 70	8 18 9		
15 cwt. bonedust ..	4 12 56	1 6 30	5 18 86	10 10 0		
In favour of super and Ephos	0 3 58	0 3 38	0 6 96	..	4 2 3	5 13 6
	N.S.	N.S.	N.S.			
15 cwt. super and bonedust	4 8 49	1 10 40	5 18 89	9 12 5		
15 cwt. super and Ephos	4 16 2	1 9 68	6 5 70	8 18 9		
In favour of super and Ephos	0 7 65	..	0 6 93		4 1 11	4 15 7
In favour of super and bonedust	..	0 0 84				
	N.S.	N.S.	N.S.			

S. = Significant difference ; N.S. = Non-significant difference.

COMMENTS ON TABLE 3.

The odds here are not great enough to be regarded as significant, on account of the soil-variation, but the results go to show that both super and bonedust and super and Ephos tend to give better results than bonedust alone.

General Conclusions.

While it is rather risky to generalize from too few data, some important points stand out from the results secured so far. It must be remembered that as the tilth of the soil plays so important a part with potatoes the response to manures will vary very greatly with the thoroughness or otherwise of cultivation.

(1) Bonedust can be replaced partly and in some cases wholly by mineral phosphates.

(2) The inclusion of superphosphate in the mixture has in practically every case resulted in an increased yield, besides lessening the cost of the manure. Early ripening has also been encouraged.

(3) Where there is a good supply of humus in the soil it is probable that the use of bonedust can be dispensed with altogether, and a mixture of mineral phosphates such as super and Ephos substituted.

(4) The residual effects of bonedust are far outweighed by the increased return where super is used. In some cases this profit has amounted to more than the cost of the manure used. What effect the residues will have on the succeeding crop of potatoes will be probably seen later.

(5) These results were obtained in a season when the rainfall was about the average. There is every reason to suppose that in a drier season the odds would still further favour the water-soluble superphosphate.

(6) The results of these experiments suggest further investigations. Questions which should be answered by field trial are: (*a*) How far can super profitably replace slower-acting phosphates like bonedust and rock phosphates? (*b*) Can the total amount of manure used per acre be economically reduced?

We offer the growers, Messrs. B. V. Bilkey, E. J. Campbell, and A. Wright, our thanks for their co-operation in securing the results recorded. We thank Mr. A. E. Lovell, Stationmaster, Pukekohe, for information freely given. We also acknowledge the help rendered by our colleagues in the Fields Division.

Tenures of Land-holdings.—The official agricultural statistics give the following particulars concerning the tenures of occupied land in New Zealand for 1926: Freehold (including land held on deferred payment), 20,451,217 acres; Crown leases and licenses, 19,007,447 acres; leases from private individuals or public bodies, 2,549,538 acres; leases from Maoris, 1,598,482 acres; unspecified, 145 acres. Freehold land formed 46·90 per cent. of the total area occupied in 1926, as compared with 47·06 per cent. in the preceding year.

TESTING OF PUREBRED DAIRY COWS.

REVIEW OF THE NEW ZEALAND CERTIFICATE-OF-RECORD SYSTEM IN 1926.

W. M. SINGLETON, Director of the Dairy Division, Wellington.

THE support accorded to our certificate-of-record testing organization during the calendar year 1926 has been somewhat disappointing. The zenith of the testing was attained in 1924, during which year 933 purebred cows and heifers were granted certificates. For 1925 this number decreased to 806, while for the period under review—the calendar year 1926—only 576 yields were authenticated and certificates of record issued. The fact that the number of cows at present undergoing test is less than for the corresponding period a year ago would suggest that another season must pass before we can look for stronger support of this important branch of the Dairy Division's activities.

Many reasons for this depression have been advanced, but, while there are doubtless several contributing factors, the major cause can probably be found in the general economic stringency existing of late, which has made it difficult for many breeders to provide the extra care and feed that cows undergoing C.O.R. test generally require.

A few breeders have complained of the amount of the testing fee, while others have referred to the drop in the average sale price of purebred dairy cattle. When selling-prices fell so appreciably many breeders began to doubt whether C.O.R. testing was worth the trouble and expense. Breeders should not lose sight of the fact, however, that even with purebred-dairy-cattle prices at their lowest the difference in value between tested and untested strains is sufficient to more than recompense the cost and labour of testing. Another reason — and possibly a potent influence —is that for some years C.O.R. testing has been entered into by some breeders as a kind of record-breaking competition, and as time goes on higher records for class and breed leaderships become increasingly difficult to attain. The effect of this phase is a very far-reaching one. The ordinary breeder with an average herd, and average capital to expend on the handling of his herd, is more or less debarred from the outset, and the larger breeder restricts his test team to a few specially selected individuals upon which every care and much expense is bestowed. On the other hand, smaller breeders—that is to say, ordinary farmer breeders—should be encouraged by the fact that many of our best records have been made by them. And all breeders should remember that construction is more desirable than competition, and in this time of stress each must work for the ultimate good of all.

Some idea of the progress made in butterfat production under the C.O.R. system may be gained by comparing our summary for 1913 with that for 1926. The table which follows indicates the improvement in average production, class by class, of the certificated cows of the two most heavily represented breeds, the Friesians and the Jerseys.

Class.	Average Yield for 1913 Season.		Average Yield for 1926 Season.		Increase in Average Yield for 1926.
	Number of Cows.	Butterfat.	Number of Cows.	Butterfat.	
		Jerseys.			
		lb.		lb.	lb.
Two-year	19	325·14	237	411·58	86·44
Three-year	17	379·61	61	491·43	111·82
Four-year	11	391·65	33	527·11	135·46
Mature	20	413·42	97	543·13	129·71
		Friesians.			
Two-year	13	336·67	54	423·38	86·71
Three-year	14	415·70	17	497·25	81·55
Four-year	4	379·84	11	585·59	205·75
Mature	17	431·90	28	549·41	117·51

The question of individual records is less important, though interesting. Appended is a comparison of the yields of the class-leaders in 1913 with those of 1926. Only the Jersey and Friesian breeds can be included, these being the only two breeds participating in 1912–13, the first year of the C.O.R. system. It may also be mentioned that at the outset only four classes were recognized, and the present classification has therefore been adjusted to permit of a convenient comparison. The figures are as follows :—

Class.	Yield of Butterfat in 1913.	Yield of Butterfat in 1926.	Increase in Highest Yield of Butterfat for Class.
	Jerseys.		
	lb.	lb.	lb.
Two-year	524·29	768·46	244·17
Three-year	451·68	905·01	453·33
Four-year	430·71	780·32	349·61
Mature	514·92	1,056·40	541·48
	Friesians.		
Two-year	430·82	805·77	374·95
Three-year	644·54	863·51	218·97
Four-year	434·58	939·78	505·20
Mature	659·31	1,145·24	485·93

So far as the testing fee is concerned, one or two points may be briefly emphasized. The Dairy Division endeavours to combine the utmost efficiency with the utmost economy. Men of high calibre are appointed as testers under the C.O.R. system, and consequently these officers must be paid a higher salary than are testers in some other countries where the testing is carried out by juniors or college students. In order to keep down costs several of our testing officers add to the Department's revenue by conducting association herd-testing between their hours of checking the yield of purebred cows on C.O.R. test. Despite this fact the Department contributes about two-thirds of the

cost of carrying out the C.O.R. work. In addition, the various breeders' associations with whom we co-operate in conducting the testing provide liberal assistance by way of subsidies and awards, which still further decreases the breeders' share of the cost. Only the highest possible standard of authenticity is desirable, and the necessary service required to assure such authenticity cannot be run at low expenditure. C.O.R. records stand for all time, and permanent records are essential to purebred breeding operations. Until the number of cows per breeder is increased the testing fees cannot be lowered by the Department without further entrenching on the Consolidated Fund. Breeders can assist the State, the country, and themselves by increasing the size of their test teams. The average number of cows tested per breeder is at present about three and one-third. By increasing this number breeders can materially reduce the cost per record.

The period through which New Zealand breeders are now passing is much the same as that of those larger countries where similar testing work is carried on more extensively. Notably in the United States of America and in Canada the purebred-cattle business appears to have passed the nadir of its depression and is now on the ascendant. It is hoped that the depression in New Zealand will not be of longer duration than was the case in those countries.

CERTIFICATES ISSUED.

The total number of purebred dairy cows which have gained first-class certificates of record has now passed the five thousand mark, the exact figure at the end of 1926 being 5,329. During the past year certificates were issued to 498 cows on first performance, and to 78 cows on second or subsequent performances, the total being 576 certificates. The following table supplies details, the corresponding figures for 1925 being also given for purposes of comparison :—

Breed.	1926.			1925.		
	Ordinary.	Repeat.	Total.	Ordinary.	Repeat.	Total.
Jersey	372	56	428	501	98	599
Friesian	94	16	110	107	40	147
Milking Shorthorn ..	9	3	12	24	6	30
Ayrshire	15	1	16	20	3	23
Red Poll	8	2	10	6	1	7
Totals ..	498	78	576*	658	148	806

* Representing 575 cows, one cow having qualified for two certificates within the year.

Second-class Certificates.—During 1926, second-class certificates were issued for twenty-three Jerseys, eight Friesians, and one Milking Shorthorn. Grouping the cows of each particular breed into one class, the twenty-three Jersey records averaged 421·27 lb. butterfat, and the eight Friesians 518·47 lb. The Milking Shorthorn, a mature cow, yielded 489 lb. butterfat. The proportion of second-class certificates to first-class certificates of record continues to represent a neglible percentage, which suggests that breeders are doing all possible to have

their cows calve in time for a first-class C.O.R. Concerning this point of subsequent calving, it may be interesting to mention that for cows gaining first-class certificates of record the average number of days between calving for commencement of test and calving subsequent to test for cows gaining certificates in 1926 was 391 days. For cows qualifying for second-class certificates in the same year the average period was 470 days. Readers will doubtless be conversant with the fact that our C.O.R. rules governing calving provide that for a first-class certificate of record the period between calving for commencement of test and calving subsequent to test shall not exceed 455 days (fifteen months), while for a second-class certificate of record the period is extended to 485 days (sixteen months).

JERSEYS.

Class-leaders.

The year under review brought two changes in Jersey class-leaders, and in each of these cases the previous highest record for the class was raised by an appreciable amount. Mr. P. J. Petersen's Ivondale Golden Rainbow, which gained a certificate for 768·46 lb. butterfat, displaced Mr. W. J. Chynoweth's Marshland's Stylish Princess for the senior two-year-old leadership by 52·71 lb. The three-year-old Loo's Queen (Mr. A. Christie), with 797·32 lb. fat, gave way to Ivondale Golden Lass, with 905·01 lb., a difference of no less than 107·69 lb. This cow, which was also bred and tested by Mr. P. J. Petersen, is now owned by Mr. A. E. Watkin, of Takanini, and Ivondale Golden Rainbow by Mr. Truby King, Stratford.

The Jersey class-leaders now stand as follows :—

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Fat.
		Yrs. dys.	lb.		lb.	lb.
Junior Two-year-old.						
Keston Flower ..	G. E. Yelchich, Waiuku	1 359	240·5	365	11,472·2	694·28
Senior Two-year-old.						
Ivondale Golden Rainbow	P. J. Petersen, Waitara	2 311	271·6	365	12,962·2	768·46
Three-year-old.						
Ivondale Golden Lass	P. J. Petersen, Waitara	3 312	308·2	365	14,434·8	905·01
Four-year-old.						
St. Lambert's Bell ..	A. J. Smith, Cardiff ..	4 283	341·8	365	14,423·1	780·32
Mature.						
Holly Oak's Annie ..	W. T. Williams, Pukehou	5 9	350·0	365	18,522·7	1,056·49

Jersey Class-averages.

The average C.O.R. Jersey for 1926 produced 461·68 lb. butterfat, which, compared with 1925 at 458·91 lb., shows an increase of 2·77 lb. The length of average lactation—346 days—remains the same for both years. Of the 428 Jerseys certificated last year no less than 186, or about

43½ per cent. of the total, are in the class for cows calving for commencement of test at the age of 2 years 92 days or under—that is, the junior two-year-old. A perusal of the table of class-averages will show that for this breed every class except the senior two-year-old shows a creditable increase over the class-average for the preceding twelve months. The senior two-year-olds dropped slightly by 2·42 lb. butterfat. Some 428 certificates were awarded to Jersey cows, as compared with 599 for 1925.

The class-averages for 1926 and 1925 are given in the following table :—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
	1926.		lb.	lb.
Junior two-year-old ..	186	347	7,128·7	399·62
Senior two-year-old ..	51	340	8,059·6	455·22
Three-year-old	61	345	8,784·8	491·43
Four-year-old	33	347	9,405·9	527·11
Mature	97	350	9,794·1	543·13
	1925.			
Junior two-year-old ..	237	344	7,132·1	395·71
Senior two-year-old ..	59	347	8,154·6	457·64
Three-year-old	79	346	8,634·7	480·85
Four-year-old	47	352	9,484·4	523·82
Mature	177	345	9,501·6	516·94

The following table shows the averages, class by class, of all certificates issued to Jersey cows since the commencement of the C.O.R. system in 1912 :—

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Butterfat.
			lb.	lb.
Junior two-year-old ..	1,570	345	6,918·1	385·80
Senior two-year-old ..	444	344	7,668·6	430·67
Three-year-old	636	342	8,298·1	418·97
Four-year-old	388	344	8,763·8	425·35
Mature	1,052	345	9,276·1	507·15
All	4,090	344	7,995·8	443·22

Jersey C.O.R. Bulls.

As breeders will be aware, a bull is entitled to be called a certificate-of-record bull when he has sired four certificate-of-record daughters, each daughter being from a different dam. In addition, the Jersey Breeders' Association recognizes a special class for what it terms champion butterfat bulls. A champion butterfat bull is one which has at least five C.O.R. daughters from different dams, each daughter having doubled its minimum butterfat requirement for certificate. Up to the

end of 1926 some 247 Jersey bulls had qualified for the C.O.R. list, while ten of these were eligible for inclusion in the champion class. In the appended list champion butterfat bulls are marked †. On account of the dimensions which our C.O.R. bull lists have now attained it has been found necessary to abandon the publication of the full list each year, and to give instead only those C.O.R. bulls which have added to their number of C.O.R. daughters during the year, or have during that period newly qualified for the class. The list is as follows :—

Key to numbers opposite names: First number—first-class C.O.R. daughters; second number—ditto, qualified on subsequent performances; third number—second-class C.O.R. daughters; fourth number—total of preceding three numbers. Bulls marked * qualified for C.O.R. list in 1926.

Grannie's Knight† ..	50	9	3	62
Te Rapa Lad ..	25	2	0	27
Viola's Golden Laddie ..	21	6	1	28
Neathead's Majesty ..	18	5	2	25
V.C.†	18	3	0	21
Belvedere Bilberry's Last	17	1	0	18
Soumise Tom† ..	16	2	2	20
Waipiko Masterpiece† ..	16	3	1	20
The General	15	6	2	23
Sunflower's Perseus† ..	15	4	0	19
Meadowvale Conqueror	15	2	0	17
Bilberry's Twylish† ..	15	1	2	18
The Owl's Victor ..	15	0	2	17
Hawkesbury Emperor ..	14	5	0	19
Bilberry's Goddington ..	14	3	0	17
Renown of Meadowbrook	14	3	0	17
Bridge View's Magnet ..	13	0	0	13
Pecuarius	13	0	0	13
Owler of Puketapu† ..	12	0	2	14
Rainbow's King† ..	11	3	1	15
Maid's General ..	11	2	1	14
Eileen's Fox	10	2	0	12
Charm's Lord ..	10	1	1	12
Meadowvale General Daisy	10	0	1	11
Brampton Merry Boy ..	10	0	0	10
Masterpiece of Meadowbrook	10	0	0	10
Distinction's Twylish ..	9	0	1	10
Fox's Double	9	0	0	9
Woodstock Golden Lad	8	1	1	10
Shamrock of Beachlands	8	1	0	9
Grannie's Campanile Sultan	8	1	0	9
Belvedere Silver Trumpeter	8	0	0	8
Waipiko Leonard ..	8	0	0	8
Miro Meadows Maori Boy	7	3	0	10
Ivondale's Rainbow ..	7	2	0	9
Avoca's Protection ..	7	1	0	8
Rita's Molina	7	1	0	8
Golden Swan's Lad ..	7	1	0	8
Napper	7	0	0	7
Miro Meadows Glaxo ..	7	0	0	7
Una's Nobility ..	7	0	0	7
Aster's Golden Lad ..	6	2	0	8
Beachlands King Pin ..	6	2	0	8
Belvedere Sun King ..	6	1	0	7
Golden Reef*	6	1	0	7
K See 7th	6	0	2	8
Beechlands Field Marshall	6	0	0	6
Iliaeus*	6	0	0	6
Marshlands Masterpiece*	6	0	0	6
Molly's Lad	6	0	0	6
Miro Meadows Toby ..	6	0	0	6
Majesty's Eminent* ..	6	0	0	6
Ravenswood Model ..	6	0	0	6
Vulpes of Bull's ..	6	0	0	6
Willowbrook Lord* ..	6	0	0	6
Middlewood's Eminent ..	5	2	1	8
Tiki's Twylish* ..	5	2	1	8
Beachlands Leo ..	5	0	0	5
Capsicum's Maple ..	5	0	0	5
Miro Meadows A.I.* ..	5	0	0	5
Noble Warder ..	5	0	0	5
Queen's Glory Lad ..	5	0	0	5
Fox's Ring*	4	0	1	5
Maid's Egyptian General*	4	0	1	5
Froth*	4	0	0	4
Hawkesbury Golden Light*	4	0	0	4
Magnet's Glory* ..	4	0	0	4
Monarchist*	4	0	0	4
Orange Dale Draconis*	4	0	0	4
St. Aubin's Golden Lad*	4	0	0	4
Willow Brook Admiral*	4	0	0	4

FRIESIANS.

Class-leaders.

It is now three years since the list of Friesian class-leaders experienced any changes. While several good yields have been authenticated during the past calendar year none has been sufficiently high to supplant the existing class-record. Only quite exceptional cows can hope to do that, so that further changes will doubtless be slower in coming than in the early years of C.O.R. testing. In order to preserve the completeness of this review the list is here repeated.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Fat.
		Yrs. dys	lb.		lb.	lb.
Junior Two-year-old.						
Monavale Queen Bess	T. H. Richards, Cardiff	2 16	242·1	365	20,501·1	740·50
Senior Two-year-old.						
Netherland Princess 4th	John Donald, Westmere	2 341	274·6	365	19,621·6	805·77
Junior Three-year-old.						
Monavale Queen Bess	T. H. Richards, Cardiff	3 56	282·6	365	21,609·3	800·18
Senior Three-year-old.						
Manor Beets Daughter 2nd of Ashlynn	C. A. Hopping, Palmerston North	3 296	306·6	365	18,733·9	863·51
Junior Four-year-old.						
Westmere Princess Pietertje	John Donald, Westmere	4 156	329·1	365	24,199·0	939·78
Senior Four-year-old.						
Bainfield 27th ..	C. H. Potter, Pukerau	4 351	348·6	365	23,203·3	910 74
Mature.						
Alcartra Clothilde Pietje	Vernon Marx, Mangatoki	7 355	350·0	365	31,312·5	1,145 24

Friesian Class-averages.

Of the seven classes into which the Friesian breed is subdivided four show increases for 1926 as compared with 1925, while three have not maintained the average production of the preceding year. As is the case with the Jersey breed, the junior two-year-old class is numerically the strongest, and in the Friesian breed this class represented almost 40 per cent. of the total certificates issued for the year. In total numbers 110 certificates were issued to Friesians in 1926, as against 147 in 1925. In the latter year the average C.O.R. Friesian was credited with 499·93 lb. butterfat, while for 1926 this has decreased to 483·10 lb. fat. In considering this decrease, however, we must not lose sight of the fact that many of the classes are sparsely represented, and individual performances, therefore, have a marked influence on the breed average. The figures for 1926 and 1925 are as follows: —

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
	1926.		lb.	lb.
Junior two-year-old ..	43	331	11,479·7	405·80
Senior two-year-old ..	11	356	14,086·2	492·10
Junior three-year-old ..	9	357	12,727·7	458·16
Senior three-year-old ..	8	331	14,114·1	541·22
Junior four-year-old ..	7	348	17,144·2	598·87
Senior four-year-old ..	4	348	17,062·3	562·36
Mature	28	348	15,723·4	549·41

FRIESIAN CLASS-AVERAGES—*continued.*

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
	1925.		lb.	lb.
Junior two-year-old ..	44	349	12,094·8	428·09
Senior two-year-old ..	13	357	12,565·3	442·42
Junior three-year-old ..	13	319	12,048·5	436·60
Senior three-year-old ..	11	328	13,358·8	492·47
Junior four-year-old ..	5	336	15,458·6	548·46
Senior four-year-old ..	8	352	16,301·8	581·85
Mature	53	332	16,559·3	573·82

The following table shows the averages, class by class, of all certificates issued for Friesian cows since the commencement of C.O.R. testing in 1912 :—

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
			lb.	lb.
Junior two-year-old ..	416	345	11,232·4	398·86
Senior two-year-old ..	190	347	12,238·9	433·23
Junior three-year-old ..	146	341	13,071·7	459·73
Senior three-year-old ..	143	339	13,639·3	486·07
Junior four-year-old ..	92	342	14,581·7	514·91
Senior four-year-old ..	86	347	15,658·5	542·07
Mature	416	339	15,391·1	537·93
All	1,489	343	13,397·4	471·89

Friesian C.O.R. Bulls.

The Friesian C.O.R. bulls now total eighty-eight, and of these sixteen are eligible for inclusion in the present summary. Three new names were added during the year. The list is as follows :—

Key to numbers opposite names: First number—first-class C.O.R. daughters; second—ditto, qualified on subsequent performances; third—second-class C.O.R. daughters; fourth—total of preceding three numbers. Bulls marked * qualified for C.O.R. list in 1926.

Rosevale Korndyke Sylvia Posch ..	15	11	2	28
Rosevale King Sylvia ..	13	3	3	19
King Laddie	8	2	1	11
Black and White King of Ashlynn	8	0	1	9
Felix de Kol of Monavale	7	2	0	9
Dominion Woodcrest Beets	7	0	0	7
Ensign Pontiac Valdessa Fayne*	7	0	0	7
Salma Torohunga No. 1	7	0	0	7
Woodcrest Pontiac Alcartra	6	2	1	9
Dominion de Kol Domino	6	2	0	8
Dominion Woodcrest King Segis of Rock ..	6	0	0	6
Brooklands Waihi Segis	5	1	0	6
Bonheur King* ..	5	1	0	6
Rosevale Plus Triumph	5	1	0	6
Rex Paxton of Monavale*	5	0	0	5
Best of Tikorangi* ..	4	0	0	4

AYRSHIRES.

Class-leaders.

The past year saw several good Ayrshire certificates gained, but failed to bring any changes to the class-leaderships of the breed. The list as it stood at the end of 1925 is accordingly reprinted, as follows :—

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Fair Maid of Greenbank	W. Moore, Homebush	2 27	243·2	365	12,281·3	673·56
Three-year-old.						
Ivanhoe Stylish Daisy	A. M. Weir, Menzies Ferry	3 312	308·2	365	12,334·2	574·09
Four-year-old.						
Ivanhoe Fancy ..	A. M. Weir, Menzies Ferry	4 308	344·3	365	14,207·7	713·93
Mature.						
Glencairn Brownie ..	A. Montgomerie, Kauwhata	8 360	350·0	365	15,579·4	728·05

Ayrshire Class-averages.

The Ayrshire breed occupies a similar position to that of the other C.O.R. breeds in that it was represented to a lesser extent in 1926 than in the preceding year. The number of certificates issued was sixteen for 1926 and twenty-three for 1925. The average yield also showed a falling-off, principally due to the influence of the 1926 two-year-olds, whose production was considerably below the usual average in that class of the breed. The mature class included some very fine records—one at 695 lb., one at 678 lb., and another at 586 lb. butterfat—but these were not enough to bring the average up to that of 1925. The 1926 breed average was 440·31 lb. butterfat, and that for 1925 some 73 lb. higher. The class-averages for 1926, together with those for the preceding year, are as follows :—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
	1926.		lb.	lb.
Two-year-old	3	339	6,454·6	274·22
Three-year-old	1	333	7,897·7	371·73
Four-year-old	2	365	11,426·2	405·22
Mature	10	360	13,125·0	504·01
	1925.			
Two-year-old	5	365	12,298·0	512·54
Three-year-old	2	341	9,162·6	354·84
Four-year-old	3	345	14,043·4	549·24
Mature	13	348	12,743·0	529·69

The following table shows the averages, class by class, of all certificates issued to Ayrshire cows since the commencement of C.O.R. testing in 1912 :—

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
			lb.	lb.
Two-year-old	43	343	8,769·9	358·15
Three-year-old	27	347	9,813·4	400·85
Four-year-old	21	349	11,320·4	458·42
Mature	85	349	11,808·5	484·62
All	176	347	10,701·6	437·74

Ayrshire C.O.R. Bulls.

Six Ayrshire bulls are again qualified for the C.O.R. bull list, the number being unaltered since last year's review. Only one bull, Hindsward Jimmie of Townhead, has added to his number of C.O.R. daughters during the year, his figures being 13–1–0–14.

MILKING SHORTHORNS.

Class-leaders.

One change has taken place in the Milking Shorthorn class-leaderships, this falling in the senior two-year-olds. Mereside Gem, with 461·52 lb. butterfat, and tested by Mr. W. Bowis, Doyleston, gives way to Messrs. Ranstead Bros.' Matangi Quality 5th, with 542·66 lb. It will be noted that of the seven classes recognized by the Milking Shorthorn Association six leaderships are held by cows bred and tested by Messrs. Ranstead Bros., of Matangi—a remarkable achievement. The list is as follows :—

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Matangi Quality 4th	Ranstead Bros., Matangi	2 109	251·4	365	14,572·8	591·89
Senior Two-year-old.						
Matangi Quality 5th	Ranstead Bros., Matangi	2 204	260·9	365	11,752·8	542·66
Junior Three-year-old.						
Matangi Quality 4th	Ranstead Bros., Matangi	3 153	292·3	365	16,281·4	678·02
Senior Three-year-old.						
Matangi Ruth 2nd ..	Ranstead Bros., Matangi	3 304	307·4	365	14,032·7	747·86
Junior Four-year-old.						
Matangi Nancy 2nd	Ranstead Bros., Matangi	4 3	313·8	365	15,591·6	608·28
Senior Four-year-old.						
Matangi Ruth 2nd ..	Ranstead Bros., Matangi	4 355	349·0	340	11,670·3	644·90
Mature.						
Glenthorpe Lady ..	A. J. Melville, Buckland	Mature	350·0	365	20,136·2	856·85

Milking Shorthorn Class-averages.

During the year under review twelve certificates were issued to Milking Shorthorn cows, as compared with thirty certificates for 1925. The average yield of the twelve cows certificated last year was 508·89 lb. butterfat, which is some 30 lb. above the 1925 average of 478·38 lb. Here, again, the influence of individual records is considerable, five of the seven classes having only one representative each. The class-averages for the Milking Shorthorn breed for the past two years are as follows :—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
	1926.		lb.	lb.
Junior two-year-old ..	3	346	10,448·8	435·19
Senior two-year-old ..	1	365	11,752·8	542·66
Junior three-year-old ..	1	300	8,978·2	361·77
Senior three-year-old ..	1	365	13,954·6	688·75
Junior four-year-old ..	1	361	10,142·8	402·19
Senior four-year-old ..	1	365	14,850·0	635·91
Mature	4	337	13,893·9	542·45
	1925.			
Junior two-year-old ..	7	345	8,943·7	367·18
Senior two-year-old ..	1	365	11,286·3	461·52
Junior three-year-old ..	1	305	11,790·5	498·93
Senior three-year-old ..	2	330	10,344·5	463·93
Junior four-year-old ..	3	345	9,598·5	423·88
Senior four-year-old ..	1	360	12,081·1	498·11
Mature	15	335	13,380·3	541·55

The following table shows the averages, class by class, of all certificates issued to Milking Shorthorn cows since the commencement of C.O.R. testing for this breed in 1914 :—

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
			lb.	lb.
Junior two-year-old ..	40	352	8,520·3	352·33
Senior two-year-old ..	23	346	8,459·0	341·23
Junior three-year-old ..	19	334	9,594·2	381·27
Senior three-year-old ..	17	344	10,839·8	463·43
Junior four-year-old ..	16	349	10,501·0	422·23
Senior four-year-old ..	17	347	11,927·5	480·58
Mature	211	341	11,514·6	459·06
All	343	343	10,815·1	433·09

Milking Shorthorn C.O.R. Bulls.

The C.O.R. bulls of this breed total five, the number remaining the same as at the close of 1925. Only one bull, Marlborough of Darbalara,

has added to his number of C.O.R. daughters during the year. His figures now stand at 6–0–0–6 (see key at head of Jersey or Friesian list).

RED POLLS.

Class-leaders.

The year under review brought one change of class-leadership to the Red Poll breed. This occurred in the four-year-old class, where Mr. B. W. Harvey's Susie Ann, with 448·48 lb. butterfat, superseded the Central Development Farm's Dominion Opticia by a margin of 7·21 lb. The present class-leaders are as follows :—

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days	Milk.	Fat
Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Wayward 6th B No. 1	G. S. Young, West Plains	2 188	259·3	365	11,228 0	511·42
Three-year-old.						
Dominion Gold Top..	Central Development Farm, Weraroa	3 302	307·2	365	9,491·25	459·46
Four-year-old.						
Susie Ann	B. W. Harvey, Waverley	4 65	320·0	354	11,109·3	448·48
Mature.						
Dominion Sylph ..	Central Development Farm, Weraroa	5 4	350·0	365	11,009·00	505·84

Red Poll Class-averages.

During 1926 ten Red Polls gained certificates, an increase of three over the preceding year. Only three of the four classes were represented, no three-year-olds having been under test. The class-averages for 1926 and 1925 are as follows :—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
	1926.		lb.	lb.
Two-year-old	4	322	7,257·9	306·86
Four-year-old	1	354	11,109·3	448·48
Mature	5	312	9,239·3	385·13
	1925.			
Two-year-old	6	346	7,938·9	365·97
Three-year-old	1	333	9,185·6	410·39

The following table shows the averages, class by class, of all certificates issued to Red Poll cows since the commencement of C.O.R. testing for this breed in 1918 :—

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
			lb.	lb.
Two-year-old	26	339	7,547·0	339·58
Three-year-old	11	343	8,066·4	351·85*
Four-year-old	5	340	9,233·0	395·02
Mature	15	325	9,693·0	419·20
All	57	336	8,359·9	367·75

* No additional cows.

Red Poll C.O.R. Bulls.

No new Red Poll bulls have been added to the list during the year, and none of the bulls previously qualified has added to his number of C.O.R. daughters. The three Red Poll C.O.R. bulls are Aviator, Belligerent, and Force Majeure.

The secretaries of those breeders' associations who co-operate with the Dairy Division in the carrying-out of the C.O.R. testing are constantly rendering valuable assistance, and we thank once again the various officers concerned — Messrs. W. M. Tapp (Jersey), J. P. Kalaugher (Friesian), W. Hunter (Milking Shorthorn), R. H. Spencer (Ayrshire), and L. J. Wild (Red Poll).

NOTE.—The closing list of records for cows which gained certificates in 1926 will be published in next month's *Journal*.

EXPORT OF PUREBRED DAIRY CATTLE.

IN 1926 a total of forty-one head of purebred dairy cattle were exported from New Zealand. Of these, fourteen went to Argentina, twenty-three to Australia, three to Fiji, and one to Tonga, their total declared value being £3,521. This compares with ninety-three head of a value of £5,200 exported for the preceding year. It will be noted that, though the number of cattle exported showed a falling-off, the average value per head shows a very marked increase.—*Dairy Division.*

Minor Materials and Products of the Hive.—Pollen is collected on the body-hairs of the bee, and is carried to the hive in the pollen-baskets on the posterior legs. Stored in the cells adjacent to the brood, it is mixed with honey, and is fed as required by the nurse bees in the process of feeding the young larvæ. Lack of pollen retards, if not altogether prevents, the bees from rearing the young during the larval stage. Propolis, or bee-glue, is a resinous substance gathered by the bees from the buds and limbs of trees. It is used to stop up cracks and crevices in the hives, more particularly in the autumn months. Propolis is troublesome to the beekeeper in some districts, making it well-nigh impossible to manipulate the frames unless they are staple-spaced. Tar is often gathered in liberal quantities as a substitute for propolis. Beeswax is not gathered by the bees, as is commonly supposed, but is produced during the process of comb-building. A high temperature is necessary for the secretion of wax. The bees hang in clusters in a state of repose, consuming honey in the meantime, which, being converted into wax, is formed into scales on the wax-plates on the under-side of the abdomen of the workers. It is estimated that from 10 lb. to 12 lb. of honey is consumed to produce 1 lb. of wax.—*Bulletin No. 128, "Beekeeping."*

THE OFFICIAL SEED-TESTING STATION.

RECORD OF OPERATIONS FOR 1926.

N. R. Foy, Seed Analyst, Biological Laboratory, Wellington.

For the twelve months ended December, 1926, 8,627 seed-samples were tested at the Seed-testing Station of the Agriculture Department, showing an increase of 481 over the previous year. The aggregate was made up as follows: Commercial samples, 6,852 (fees payable); commercial retests, 143 (gratis); farmers' samples, 399 (gratis); Government Departments' samples, 289; special laboratory tests, 944.

Germination test only was required for 6,731 of the samples; purity only for 111 samples; and both purity and germination for 1,785 samples. An increase in the number of samples received from farmers—399, as compared with 203 in 1925—is noticeable.

Table 1.—Number of Samples received in each Month, 1926 and 1925.

Month.	Number.		Month.	Number.	
	1926.	1925.		1926.	1925.
January	642	553	July	739	537
February	560	700	August	994	852
March	753	878	September	907	895
April	546	659	October	1,096	740
May	650	592	November	723	683
June	616	674	December	401	403

Table 2.—Number of Samples tested of the various Species (excepting Special Laboratory Tests), 1926 and 1925.

Species.	1926.	1925.	Species.	1926.	1925.
Lucerne	85	62	Paspalum	113	77
Alsike	69	75	Poa pratensis	66	60
White clover	333	257	Prairie-grass	34	25
Cow-grass and red clover	317	276	Other grasses	65	61
Crimson clover ..	23	35	Japanese millet ..	32	28
English trefoil	31	38	Oats	31	48
Lotus major	83	55	Other cereals	50	42
Other clovers	73	60	Mangolds	171	249
Perennial rye-grass ..	1,744	1,178	Turnips	372	449
Italian rye-grass ..	255	260	Swedes	288	290
Western Wolths rye-grass	181	194	Rape	115	184
Timothy	88	97	Kale	35	46
Crested dogstail ..	768	874	Chou moellier	40	38
Danthonia spp. ..	68	99	Carrots	101	89
Brown-top	171	124	Mustard	20	32
Chewings fescue ..	554	431	Forest-tree seeds ..	77	23
Meadow-fescue ..	29	37	Flower-seeds	6	14
Meadow-foxtail ..	39	49	Vegetables (other than peas)	143	250
Yorkshire fog	16	25	Peas (garden)	133	197
Cocksfoot	433	387	Tares, vetches, &c. ..	14	12

The date distribution of the samples received throughout the year is shown in Table 1, and the number of samples of each species is shown in Table 2, both being compared with the preceding year.

Table 3 shows the number of samples received from the different land districts. If these figures are compared with the accompanying maps it will be seen that, excepting Auckland, most of the testing is concerned with seed production and export. The bulk of the imported samples, together with about half of the local retail samples, are received from Auckland, while those from Wellington are divided almost equally into retail, export, and production (Manawatu) groups. A small proportion of the Southland, Canterbury, and Otago samples are concerned with the retail business, but production and export are responsible for by far the greater portion.

Table 3.—Number of Samples received from Merchants and Farmers in the Different Land Districts.

District.	Number.	District.	Number.
Southland	1,979	Marlborough	129
Wellington	1,900	Taranaki	59
Auckland	1,320	Gisborne	9
Canterbury	1,142	Nelson	8
Otago	599	North Auckland	3
Hawke's Bay	228	Westland	Nil.

NOTE.—Nine samples were also received from New South Wales.

Table 4.—Average Germination and Purity of the Main Grasses, 1926.

NOTE.—Average germination of various species for 1925 given in parentheses after 1926 figures in second column.

Species.	Percentage of Germination.			Percentage of Samples germinating between						Average Percentage of Impurities.	
	Average.	Highest.	Lowest.	0–50.	51–60.	61–70.	71–80.	81–90.	91–100.	Useful Seeds.	Weed Seeds.
Perennial rye-grass	77 (85)	100	19	4	6	15	24	31	20	1·3	0·4
Italian rye-grass	87 (87)	100	43	1	1	3	12	39	44	0·1	0·2
Western Wolths rye-grass	81 (88)	100	43	1	2	2	15	37	43	0·3	0·1
Timothy ..	91 (84)	100	26	2	3	..	5	17	73	0·3	0·3
Crested dogstail ..	84 (79)	100	..	5	3	8	11	24	49	2·0	0·3
Cocksfoot ..	69 (69)	95	9	9	14	21	27	26	3	3·7	0·9
Brown-top* ..	78 (67)	100	3	13	8	12	10	17	40	1·0	1·0
Chewings fescue ..	82 (73)	100	2	9	2	3	10	34	42	0·6	0·3
Meadow-fescue ..	63 (73)	99	2	41	..	3	14	14	28	0·1	0·5
Poa pratensis ..	48 (51)	95	7	49	23	14	11	..	3	0·2	0·5
				0–20.	21–30.	31–40.	41–50.	51–60.	61–70.		
Meadow-foxtail ..	36 (21)	50	1	46	46	2	6	..	..	1·6	4·6
Danthonia spp. ..	46 (38)	80	..	9	15	19	15	13	29	7·7	4·9
Paspalum ..	38 (48)	77	2	14	16	22	33	7	8	0·3	0·2

* Contained an average of 33 per cent. chaff.

GRASSES.

Germination.—The average percentages of purity and germination of the main grass-seeds are shown in Table 4. The most noticeable feature is the decline in the average germination of perennial rye-grass, and the rise in that of crested dogstail and Chewings fescue, as compared with the preceding year. This demonstrates an interesting point—the difference in the humidity requirements during ripening of rye-grass and of Chewings fescue and dogstail. Both the depression in rye-grass and the rise in the other two species are due almost entirely to the wet conditions prevailing in Southland during the 1926 harvest. Rye-grass cannot tolerate humid conditions during the final maturation processes; the hotter and drier the atmosphere the better. The appearance of the seed and the weight are not materially altered, but the germ is either weakened or fails to mature. On the other hand, dogstail and Chewings fescue under these same conditions produced a very good quality seed, high humidity being favourable to complete maturation, and dry, hot weather usually unfavourable.

Table 5.—Average Germination and Purity of Perennial Rye-grass, Crested Dogstail, Cocksfoot, and Chewings Fescue, grouped according to Place of Origin, 1926 and 1925.

Origin.	Average Percentage of Impurities.	Percentage of Samples germinating in Groups—								Average Germination.		Number of Samples.	
		Under 70.		71–80.		81–90.		91–100.					
		1925.	1926.	1925.	1926.	1925.	1926.	1925.	1926.	1925.	1926.	1925.	1926.
Perennial Rye-grass.													
Southern ..	1·6	6	36	6	30	36	29	52	5	88	74	421	963
Canterbury	1·8	7	12	12	22	34	37	47	29	87	83	258	363
Sandon ..	0·5	61	18	13	16	17	32	8	34	67	81	122	102
Hawke's Bay	2·1	14	3	4	4	23	14	69	79	91	93	120	95
Dominion..	1·7	13	25	9	24	31	31	47	20	85	77	1,178	1,744
Crested Dogstail.													
Southern ..	2·3	14	11	26	11	40	24	20	54	79	87	713	563
Sandon ..	0·3	29	9	9	3	22	28	40	60	80	86	67	58
Dominion..	..	17	15	23	11	39	24	21	50	79	84	874	768
Cocksfoot.													
Akaroa ..	4·4	77	83	16	15	6	2	1	..	64	62	70	75
Danish ..	0·5	7	21	42	43	50	34	1	2	73	76	127	126
Plains ..	3·9	46	15	9	40	45	34	..	11	72	79	11	35
Dominion..	4·6	48	43	27	27	23	27	2	3	69	69	..	433
Chewings Fescue.													
Southern ..	0·9	36	10	15	10	25	38	24	42	73	82	431	554

Reference to Table 5 shows that the percentage of samples of Southern rye-grass germinating in the 91–100 group was only 5, while in 1925 more than half germinated over 90. The position for dogstail and Chewings fescue is reversed, the increase in high-germination samples being particularly noticeable. The germination of Canterbury rye-grass was depressed for the same reason — humid conditions. Southern dogstail experienced a late frost while in the milk stage, and the crop was greatly reduced; high prices have ruled in consequence. The late season was a good one for brown-top—particularly Southern seed, 50 per cent. of which germinated over 90 per cent., and twenty per cent. 80 to 90 per cent.

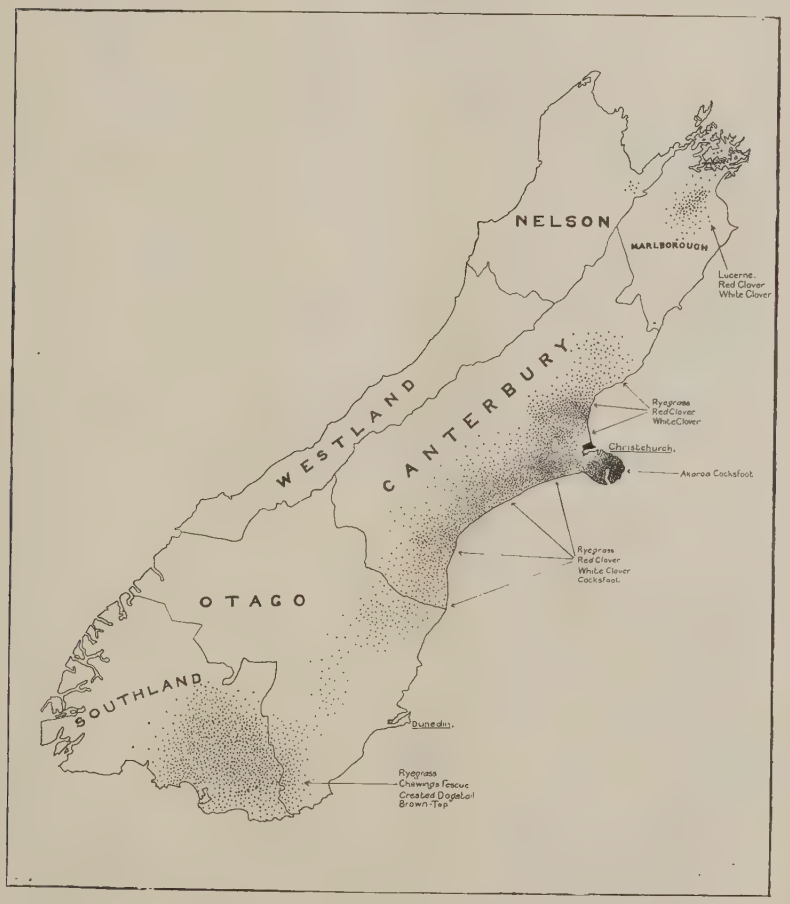


FIG. 1. GRASS- AND CLOVER-SEED PRODUCTION IN THE SOUTH ISLAND.

Each dot represents 5 tons of farmers' dressed seed.

The average germination percentages of species not mentioned in Tables 4 and 5 are as follows: Red-top, 75; fiorin, 70; Yorkshire fog, 78; Poa trivialis, 74; prairie-grass, 62; sheep's fescue, 20; rats-tail, 79; Indian doob, 96.

Table 6.—Occurrence of Main Impurities of Principal Grasses, Percentages of Seed Impurity, and Number of Impurities noted in each Species, 1926.

NOTE.—The figures placed after each impurity are the percentages of samples in which the impurity occurred in the species at the head of the column—*i.e.*, hair-grass occurred in 63 per cent. of the samples of perennial rye-grass examined.

Impurities.	Perennial Rye-grass.	Italian Rye-grass.	Cocksfoot.	Crested Dogstail.	Chewings Fescue.	Brown-top.	Timothy.	Poa pratensis.	Danthonia.
Total average percentage ..	**1·7**	**0·3**	**4·6**	**2·3**	**0·9**	**2·0**	**0·6**	**0·7**	**12·6**
Useful Seeds.									
Average percentage ..	**1·3**	**0·1**	**3·7**	**2·0**	**0·6**	**1·0**	**0·3**	**0·2**	**7·7**
Perennial rye-grass ..	..	*	95	87	91	15	19	15	65
Italian rye-grass ..	74	..	2	2	..	1	4	..	24
Cocksfoot	31	6	..	48	35	2	7	10	17
Crested dogstail	25	10	8	..	39	15	7	..	29
Chewings fescue ..	5	..	3	30	..	3	..	..	17
Agrostis sp.	1	..	7	21	8	..	46	6	34
Timothy	2	..	7	4	2	4	..	80	13
Poa pratensis	5	3	60	54	9	3	58	..	47
Danthonia sp.	2	..	4	1	2	4	..	..	..
Yorkshire fog	21	3	72	88	76	20	15	5	54
White clover	19	10	17	21	12	14	69	70	8
Alsike	10	..	2	3	2	2	92	..	4
Cow-grass	3	3	14	2	1	..	46	12	4
English trefoil	2	2	15	1	..	1	..	10	..
Lotus spp.	..	..	..	1	..	49	5	4	8
Suckling-clover	34	44	4	45	10	29	12	5	46
Total number of useful species noted	**20**	**9**	**21**	**16**	**15**	**24**	**13**	**11**	**21**
Weed-seeds.									
Average percentage ..	**0·4**	**0·2**	**0·9**	**0·3**	**0·3**	**1·0**	**0·3**	**0·5**	**4·9**
Hair-grass	63	41	13	24	51	20	7	..	75
Goose-grass	71	50	68	..	10	..	..	..	38
Catsear	25	10	36	55	82	49	..	12	47
Sweet vernal	10	6	14	26	47	23	4	..	71
Rib-grass	23	28	44	16	4	20	27	16	38
Sorrel	28	19	21	16	27	22	61	36	29
Curled dock	2	..	10	1	1	2	4	15	4
Californian thistle ..	3	..	..	40	4	3	15	..	..
Hawkweed	2	..	17	41	1	15	7	..	4
Ergot sclerotia	24	3	20	25	10	86	57	45	5
Ox-eye daisy	..	..	2	..	..	6	4	..	4
Poa annua	..	..	..	9	..	..	..	..	..
Chickweed	2	3	2	15	9	61	15	41	8
Toad-rush	..	..	2	1	4	78	..	..	..
Hawkbit	6	3	3	15	1	6	4	..	..
Total number of weed species noted	**34**	**16**	**37**	**39**	**31**	**44**	**33**	**27**	**27**

* Italian rye-grass with the distinguishing awn broken off is inseparable from perennial rye-grass in routine analyses.

Purity.—Table 6 shows the average percentages of seed impurities both useful and weed seeds—together with the percentages of samples in which the various impurities occurred, and the total number of species noted. Cocksfoot, dogstail, danthonia, and meadow-foxtail exceed 2 per cent. in total impurity, but only in the two last-named does the weed impurity exceed 1 per cent. In all these species the useful impurity was an excess of rye-grass, and in the case of danthonia the high weed-content consisted mainly of hair-grass.

Noxious impurities: Californian thistle was noted in 40 per cent. of the samples of dogstail, at the rate of 50 to 15,000 seeds per pound; in rye-grass, Chewings fescue, and brown-top in small quantities only. Ox-eye daisy occurred in Danish cocksfoot and in brown-top at the rate of 100 to 7,000 seeds per pound. A few samples of brown-top contained dodder and ragwort seed in small quantities.

Brown-top samples contained on the average 33 per cent. of chaff; Southern seed contained rarely more than 5 per cent. A few special analyses for the detection of red-top in brown-top were made, and red-top, when present, ranged from 1 per cent. to 80 per cent. of the sample. Apparently most brown-top seed is liable to red-top contamination, but usually only in very small amounts.

CLOVERS AND RELATED SPECIES.

Germination.—The average purity and germination, &c., of the main clovers and related species are shown in Table 7. There is nothing specially noteworthy except the unusually high percentage of hard seeds in lucerne. Up to the end of 1926 one-half of the hard seeds in the legumes has been allowed as viable and included in the final germination percentage. From 1st January, 1927, the percentage of germination and percentage of hard seed are being given separately, and no portion of the hard seed allowed as viable. In consequence the germination percentages reported will in most cases be lower.

Table 7.—Average Germination and Purity of the Main Clovers and Related Species, 1926.

(Average germination for 1925 in parentheses after 1926 figures in second column.)

Species.	Percentage of Germination.			Percentage of Samples germinating between				Seed Impurities.				Average Percentage of Hard Seeds.
								Number of Species noted.		Average Percentage.		
	Average.	Highest.	Lowest.	0–70.	71–80.	81–90.	91–100.	Useful.	Weed.	Useful.	Weed.	
White clover ..	89 (89)	100	9	3	7	38	52	24	54	1·8	1·5	11·5
Alsike	86 (88)	100	25	10	10	25	55	13	20	2·8	0·2	3·4
Cow-grass ..	90 (88)	100	8	5	2	15	78	22	38	0·1	0·2	5·0
Lucerne ..	83 (88)	100	..	10	25	37	28	7	13	0·1	0·1	19·4
English trefoil ..	77 (79)	98	16	19	23	39	19	4	6	0·1	0·1	4·5
Crimson clover ..	94 (95)	100	69	5	12	..	83	10	11	0·1	0·1	..
Lotus major ..	78 (75)	97	27	13	33	36	18	18	29	8·8	0·1	20·6
Subterranean clover	91 (77)	99	71	..	12	18	70	15	14	0·1	0·1	12·9
Suckling-clover ..	77 (77)	84	41	46	27	27	..	9	18	24·5	1·7	40·0

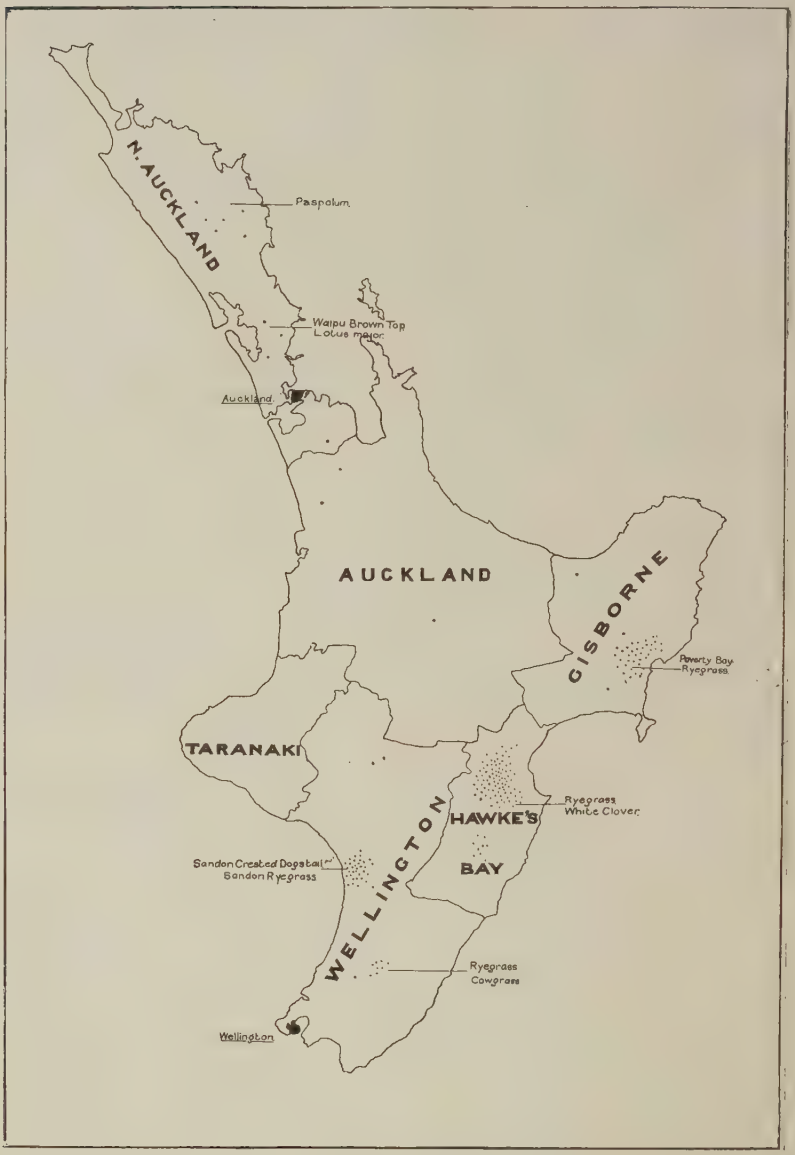


FIG. 2. GRASS- AND CLOVER-SEED PRODUCTION IN THE NORTH ISLAND.

Each dot represents 5 tons of farmers' dressed seed.

The average germination of clovers, &c., not included in the table is as follows: Lotus hispidus (angustissimus), 62 per cent.; Lotus corniculatus, 75 per cent.; Strawberry clover, 88 per cent.

Purity.—Table 7 shows the average seed-impurity percentage divided into useful and weed seeds, also number of species of impurity noted. White clover, alsike, Lotus major, and suckling-clover show over 2 per cent. of total impurity. By far the greater proportion of these total percentages are made up of useful seed, and only in white clover and suckling-clover does the amount of weed impurity exceed 1 per cent.

Noxious impurities: Dodder occurred in two samples of cow-grass in small amounts; in 5 per cent. of the white-clover samples, from twenty to one hundred seeds per pound; in 27 per cent. of the Lotus-major samples, from forty to 6,500 seeds per pound. The increasing occurrence of dodder in Waipu brown-top and in Lotus spp. indicates that this weed is spreading fairly rapidly in the Northern areas, and growers would be well advised to clear it when economically possible. Ox-eye daisy was noted in two samples of alsike only. Californian thistle was noted in 14 per cent. of alsike, one sample of white clover, and two of cow-grass—all at about twenty to thirty seeds per pound. Ragwort was noted in one sample of Southern Lotus major.

ROOTS AND CRUCIFEROUS FORAGES.

The average germination figures for this class are given in the following table:—

Table 8.—Average Germination of Roots and Cruciferous Forages, 1926.

(Average germination for 1925 in parentheses after 1926 figures in second column.)

Species.	Percentage of Germination.			Percentage of Samples germinating between					
	Average.	Highest.	Lowest.	0–50.	51–60.	61–70.	71–80.	81–90.	91–100.
Turnip ..	88 (87)	100	31	1	2	4	12	32	49
Swede ..	83 (84)	100	10	3	4	7	17	34	35
Rape ..	87 (89)	100	18	..	1	3	5	24	67
Kale ..	82 (86)	97	13	5	3	9	23	31	29
Chou moellier	82 (87)	98	29	1	3	8	20	35	33
Mangold ..	78 (74)	97	39	3	6	15	24	39	13
Carrot ..	65 (69)	91	13	15	19	24	21	20	1

CEREALS AND MISCELLANEOUS FORAGES, ETC.

Average germination percentages of these seeds were as follows: Oats, 88; wheat, 86; barley, 85; rye-corn, 72; maize, 85; Japanese millet, 91; Sudan grass, 82; sorghum, 70.

Other percentages were: Peas, 96; tares, 96; vetches, 86.

VEGETABLE-SEEDS.

The average germination percentages of vegetable-seeds tested were as follows: Beet, 78; beans, 95; cabbage, 78; cauliflower, 85; celery, 78; carrot, 65; cucumber, 94; cress, 99; leek, 52; lettuce, 94;

melon, 82; mustard, 92; onion, 75; parsley, 60; parsnip, 61; pumpkin, 90; radish, 80; rhubarb, 51; spinach, 57; squash, 97.

Acknowledgment is made of the computation of the figures in this record by Mr. W. J. Cooch and Miss E. Green, of the Seed Station staff.

LIMING AND TOP-DRESSING OF PASTURE AT WINTON EXPERIMENTAL FARM.

RESULTS FOR 1926.

R. McGillivray, F.L.S., Instructor in Agriculture, Invercargill.

The third year's detailed investigation of the pasture known as Block 3, at the Winton Experimental and Demonstration Farm, was carried out on 20th December, 1926. Throughout the past year the block was kept under very close observation. Growth continued right through the winter, and the block was stocked at the rate of six hoggets per acre at various times during winter and early spring. The basic-slag plots gave a better growth and were frequented by the sheep to a greater extent than were the other plots. In the latter part of August and up till about the middle of September the basic-slag plots were very distinct, and the exact boundaries were discernible without any guidance from the pegs marking the various plots.

The block was closed up for five weeks, and, as the weights recorded indicate, the growth was dense and a large quantity of hay was produced. The top-dressing was carried out in June, on exactly similar lines to those detailed in the previous reports in connection with work on this block. The pasture, laid down in 1920, consists of perennial rye-grass and white clover, with suckling-clover in places. It is improving with age, as pastures treated in a rational manner generally do. The stocking during the past year was very heavy, and the amount of animal-manure deposited on the pasture correspondingly great, but by means of harrowing no difficulty was experienced in keeping the pasturage in good, clean condition.

For investigating the effects of the various treatments ten weighings were taken in each plot (see diagram), commencing at 1A, and the work was completed with the weighing of plot 10E. In each plot an outside and inside (next control) weighing was taken throughout the block. The cutting was done with a two-horse mower, and the area weighed in each case was 33 ft. by 4 ft. All samples of herbage taken for chemical and botanical analysis were air-dried under cover. No great variation was found in the dry weights under the different manurial treatments, but where neither lime nor fertilizer had been applied the loss of weight on drying was nearly 9 per cent. greater than was the case where the pasturage was grown on the limed and top-dressed plots.

Following is a lay-out diagram of the block, giving the green weights of herbage for the plot cuttings:—

	1·8 Tons Carbonate of Lime. A.	3·6 Tons Carbonate of Lime. B.	No Lime. C.	2 Tons Burnt Lime. D.	1 Ton Burnt Lime. E.	Totals.	
	lb.	lb.	lb.	lb.	lb.	lb.	
Plot 1 ..	49	54	49	49	45½	501	Basic slag.
	49½	54½	52	50½	48		
Plot 2 ..	39	41	41	39½	38½	402	Control.
	40	42	44	39	38		
Plot 3 ..	50	52	58	48	45	507	Basic slag.
	48	54	54	52	46		
Plot 4 ..	41	44	41	40½	40½	419	Control.
	46	44	42	41	39		
Plot 5 ..	56½	50½	49½	50	47	507	Basic slag.
	61	56	51½	49½	45½		
Plot 6 ..	47½	46	47	45	39½	456	Nauru phosphate.
	50	45	49	47	40		
Plot 7 ..	42	40	40	37½	40½	415	Control.
	44	42	41	40	42		
Plot 8 ..	46	33½	46	39½	42½	427	Nauru phosphate.
	45	40½	46	46	44		
Plot 9 ..	40	40	46	36½	35	380	Control.
	42	32	45	35	28½		
Plot 10 ..	32½	30½	44	32	31	343	Nauru phosphate.
	37	33	45	29½	28½		

In the following table are set out the approximate average green weights of the various manured and control subdivisions under various lime treatments :—

Table 1.

		lb.
Subdivision A :	1·8 tons carbonate of lime plus 3 cwt. basic slag	104·6
,, B :	3·6 tons carbonate of lime plus 3 cwt. basic slag	107·0
,, C :	No lime ; 3 cwt. basic slag	104·6
,, D :	2 tons burnt lime plus 3 cwt. basic slag	99·6
,, E :	1 ton burnt lime plus 3 cwt. basic slag	92·3
Subdivision A :	1·8 tons carbonate of lime plus 3 cwt. Nauru phosphate ..	86·0
,, B :	3·6 tons carbonate of lime plus 3 cwt. Nauru phosphate ..	76·0
,, C :	No lime ; 3 cwt. Nauru phosphate	92·3
,, D :	2 tons burnt lime plus 3 cwt. Nauru phosphate	79·6
,, E :	1 ton burnt lime plus 3 cwt. Nauru phosphate	75·0
Subdivision A :	1·8 tons carbonate of lime—control	83·5
,, B :	3·6 tons carbonate of lime—control	81·2
,, C :	No lime—control	84·5
,, D :	2 tons burnt lime—control	77·2
,, E :	1 ton burnt lime—control	74·7

The weights per plot under the manurial scheme are shown in Table 2.

Table 2.

	Totals. lb.	Average. lb.
Basic slag—		
Plot 1	501	
Plot 2	507	505·0
Plot 3	507	
Nauru rock phosphate—		
Plot 6	456	
Plot 8	427	408·6
Plot 10	343	
Controls—		
Plot 2	402	
Plot 4	419	404·0
Plot 7	415	
Plot 9	380	

BOTANICAL ANALYSIS.

A botanical analysis was made of representative dry samples of the pasturage from each of the manurial blocks, and also of the controls on Subdivision C (Plots 2, 4, 7, and 9). Results are as follows :—

Table 3.

Blocks and Plots.	Grasses.	Clovers.	Other Plants (Weeds).	Blocks and Plots.	Grasses.	Clovers.	Other Plants (Weeds).
	Per Cent.	Per Cent.	Per Cent.		Per Cent.	Per Cent.	Per Cent.
A, 1, 3, 5	77·07	16·12	6·81	B, 6, 8, 10	80·45	12·80	6·75
B, 1, 3, 5	75·50	18·40	6·10	C, 6, 8, 10	81·60	11·60	7·80
C, 1, 3, 5	80·90	12·10	7·00	D, 6, 8, 10	81·33	12·05	6·62
D, 1, 3, 5	77·70	15·80	6·70	E, 6, 8, 10	81·27	12·00	6·73
E, 1, 3, 5	78·20	15·20	6·60	C, 2, 4, 7, 9	82·82	9·08	8·10
A, 6, 8, 10	80·85	12·45	6·70				

The analysis reveals some interesting information in connection with the clover content in the pasturage under different manurial and lime treatments. It was noted in the 1925 investigation that the clover content was lower in plots D and E, dressed with burnt lime, than was the case where equivalent dressings of carbonate of lime had been applied in plots A and B. The indications of 1925 were more apparent in the year here recorded (1926), and there is now every indication that the lime-supply in the top soil is about exhausted where burnt lime was applied in 1920. The average clover content as ascertained by analysis is as follows :—

	Carbonate of Lime. Per Cent.	Burnt Lime. Per Cent.
Basic slag	17·26	15·50
Nauru phosphate	12·62	12·02

On the plots treated with Nauru rock phosphate there has been a considerable improvement in the growth of clovers when this season's growth is compared with that of the two previous years. It would appear that an appreciable amount of the phosphate applied in previous years is now becoming available. In the two previous seasons the growth of clover was considerably earlier than it was this year, but notwithstanding this fact the clover content of the Nauru phosphate plots shows a satisfactory improvement. The plots dressed with high-grade basic slag have shown a wonderful improvement. In 1925 the highest clover content of the pasturage in any basic-slag subdivision was 12·10 per cent., while this year the same subdivision showed 18·40 per cent. of clovers.

SEASONAL NOTES.

THE FARM.

AUTUMN TILLAGE.

EVERY opportunity should now be taken on arable farms to push on with preparatory tillage for autumn- and early-winter-sown crops. Satisfactory tilth is necessary for all cereals, but for autumn-sown crops in particular the fine soil should be below and the small clods on the surface. Such a condition is most effectively brought about by the use of the tine cultivator. This so-called clod-mulch is the most effective means of keeping the surface open during winter rains, and enables spring cultivation to be more easily performed. Early preparation allows a certain amount of subsurface consolidation, and this condition is essential to enable moisture to rise to the surface by capillarity.

Where winter fallowing is commonly practised or desired for any special reason, the longer the ground is turned up to the weather the better heart will it be in during the following season. The winter fallowing assists in the complete decay of stubble and weeds left from the preceding season's crop. Where a winter fallow is intended, ploughing should be done at a fair depth on the heavier soils. In order that a rough surface may be exposed, the plough should be set so that the furrow slice is turned as much as possible on edge. Heavy types of soils are generally much benefited by a fallow, but volcanic and other light soils should not be allowed to lie in fallow during a long wet period, as considerable leaching takes place. On this class of land it is advisable to sow a cereal or catch crop for feeding off.

April is a good time for sowing oats, particularly Algerians. They get well established before the wet season sets in, provide one or more good late winter or spring feedings, and are ready to harvest from the middle to the end of December, being usually saved before rust infestation develops. Pickling of seed for smut-control should not be neglected; the formalin treatment is recommended. Malting-barley, which comes specially well after peas or clover, may also be sown during the coming month. Most of the wheat in Canterbury is sown later, in May and June, but preparation of the land should be well forward in April.

TOP-DRESSING AND LIMING OF GRASSLAND.

The recent heavy reduction in the price of fertilizers—especially locally manufactured phosphates—is acting as a great stimulus for autumn top-dressing this year. Many farmers, especially in the North, are in the habit of top-dressing their pastures in March or April with the object of producing late feed, and there has been a tendency of recent years to regard top-dressing as a substitute for forage crops. While it can never eliminate the necessity for providing auxiliary forage, autumn top-dressing certainly does stimulate growth during late autumn and early spring, and thus economizes supplementary feed—a valuable feature in seasons such as the present, when roots will no doubt be scarce in many districts.

Phosphates are still the first essentials on most New Zealand soils. They are best supplied in the form of basic slag, super, basic super,

and super and Nauru rock phosphate—half and half. Slag gives excellent results in most places, but when the extra cost per ton as compared with super, basic super, and rock phosphate is considered, the latter may well be given preference. Super will give the quickest returns, but the half-super half-Nauru mixture, or basic super, are likely to have a better building effect on the pastures. From 3 cwt. to 4 cwt. per acre is a good dressing where it is being applied for the first time. Where the land has already been top-dressed during the last two or three years, 1 cwt. less per acre should prove satisfactory.

Autumn is the best period for dealing with top-dressing work on hill country, making the best use of fine weather. Later, when the hills become wet and slippery, great difficulty is often experienced in getting the material on to the ground, and the costs of applying are materially increased. A highly concentrated phosphate such as super has obvious advantages for hill-country use, in respect to cost of transport by sledge or packhorse.

April and May are very suitable months for liming, the subsequent winter rains washing the ground limestone into the soil and causing it to gradually dissolve. Lime should be applied as a top-dressing and not be ploughed under. The tendency is for lime, once dissolved, to be washed down through the soil, and for this reason it should be incorporated with the surface and left there during winter. In some districts lime alone may not always give a satisfactory return for money invested, but in combination with super applied in the spring it rarely fails to give profitable results. Moreover, super sometimes fails to give returns unless in combination with lime. The most surely profitable use of lime, therefore, is in combination with super, and this is equally true with both pasture and lucerne. Results should not be expected too soon from lime under dry climatic conditions. In some parts of the Marlborough district, for example, it has taken as long as two years to act.

The importance of autumn harrowing of old pastures is now well recognized. It is quite optional for this operation to be carried out before or after top-dressing. As soon as autumn rains have softened the surface the tripods can be used with advantage.

PREPARATION FOR NEXT SEASON'S MANGOLD CROP.

In various districts mangolds are still comparatively neglected by dairy-farmers. When it is considered that an acre of mangolds is capable of producing 60 to 70 tons and more of feed, the labour and expense involved by the crop do not amount to very much per ton. At the rate of 40 lb. a day per head, together with 20 lb. of hay, a 60-ton crop will feed a herd of forty cows for about three months.

Mangolds do best on rich deep soils of an alluvial nature well supplied with vegetable matter, but with extra manuring and thorough cultivation they will produce a satisfactory crop on various types of land. Volcanic soils generally are quite suitable.

The cultivation both before and after the mangold crop is planted is quite as important as the amount and kind of manure used. It has been found that mangolds do better on a soil in good heart which has already been cropped once after grass than they do as a first crop on lea land. This is a result of the extra cultivation. Again,

mangolds can be grown successfully after mangolds or after potatoes. Early and deep ploughing is essential, and on heavy soils the use of the subsoiler is advisable. When grown after grass the ploughing must be done in the autumn to allow of the sod rotting sufficiently. If left till early spring, skim-ploughing followed by deep ploughing or a thorough disking of the grass-sod before ploughing is necessary. Otherwise the sod when turned under prevents the soil-water rising from below, with the result that the first dry spell is apt to stop all growth. Any well-rotted stable manure available should be applied before the land is ploughed.

THE MAIN POTATO CROP.

The main potato crop will be nearing maturity towards the end of this month and beginning of April, but harvesting should not be carried out until the haulms are properly ripened off, otherwise the keeping-quality will be impaired. The land should be dry at time of lifting; if lifted wet, trouble is frequently experienced from rotting of tubers. It is advisable to store potatoes intended for table use in an airy, dimly lighted building. For seed purposes a well-lighted place is desirable. Indoor storing enables the potatoes to be readily picked over from time to time in bad weather during winter.

RED-CLOVER ESTABLISHMENT.

Red clover, grown for the main purpose of seed-production, may either be sown with an oat crop in autumn or in the early spring just before the oats are harrowed. In the latter case the harrowing serves the double purpose of covering the clover-seed and cultivating the cereal crop. Red clover stools better after oats than after barley and wheat. Where it can be avoided, it is preferable not to sow red clover with barley and wheat, as these crops are frequently too strong to allow of the clover making vigorous growth. If such combination cannot be avoided, however, the clover should be sown in the spring. In this case the cereal crop is harvested before the clover is badly weakened or killed. From 4 lb. to 6 lb. of red-clover seed per acre provides an ample seeding.

MISCELLANEOUS.

Established lucerne-fields will greatly benefit by a top-dressing of lime at this time of the year—say, from 10 cwt. to 20 cwt. per acre—to be followed by a good dressing of super in the spring.

If not already completed, the sowing of permanent pasture may be continued in April. The danger of late sowing lies in the damage to crowns during winter frosts, and rather more clover should be sown, with perhaps some oats as a light cover-crop.

The drainage-systems on farms should now be examined. It frequently happens that the rank summer growth to a large extent blocks the outlets. As the ground becomes softened with autumn rains the drainage of any low-lying areas not yet dealt with should be pushed ahead. Make sure of a good outlet—whether it be by Dutch well, creeks, or watercourses otherwise much labour will be wasted. Plan the scheme first, and do not expect a few drains to effectively drain a large area where the soil type or fall is unfavourable.

There are still considerable areas in the South laid down to pasture with a cereal crop. This is not a very desirable practice, and frequently the grass is very weak at the time the cereal is cut. A top-dressing of super as soon as the field is cleared makes a wonderful difference, and generally ensures a successful establishment of both grasses and clovers.

—Fields Division.

THE ORCHARD.

SPRAYING.

TREES infested with woolly aphis, red-mite, or apple leaf-hopper will require to be sprayed again in order to reduce the infection as much as possible before winter. The application of oil (1 in 60) as soon as the fruit has been harvested from affected varieties has given good results. In localities where the leaf-roller caterpillar is troublesome late varieties of apples should be resprayed with arsenate of lead. It is recommended, in order to prevent a late affection of black-spot on the later-maturing varieties of apples and pears subject to this disease, that the trees should be resprayed as soon as it makes its appearance. Where brown-rot has been in evidence, gather and destroy all mummified fruits and all dead twigs about the trees. For gummosis cut out the gum-pockets and paint the wounds.

The present spraying season is practically at a close, and the time has arrived for fruitgrowers to consider the results obtained in the control of pests and diseases in their respective orchards. A thorough investigation should be made into the results obtained from the various spraying compounds used, together with the methods employed in their application, with the object of determining the factors contributing to success or to unsatisfactory results, as the case may be. The grower comparing the analysis of the present season with the results of former years will be in a position to intelligently amend his programme and eliminate any weakness found in it. Many orchardists do not keep a record of the sprays applied to the trees, or even a note of the actual results obtained. It is in every grower's own interest that such a record should be kept.

HARVESTING AND STORAGE OF FRUIT.

During the coming weeks this work will be engaging most of the orchardist's attention. Every endeavour should be made to pick the fruit as soon as it is ready. It is again necessary to emphasize the necessity for careful handling, as the percentage of damaged fruits arriving on the markets is much higher than it should be.

The result of careless handling is frequently not felt so severely during the earlier part of the season, when the fruit is sold immediately after it is picked, as it is with the later varieties which are usually held for a time. Fruit intended for storage should be most carefully handled and graded, and all bruised fruits, and fruits with a broken skin or with other blemishes detrimental to quality and appearance, should be rejected for cold storage. The graded fruit should be placed in the cold store as soon as possible after picking.

A little trouble in the way of placing the various sizes and grades of fruit in the store so that they may be readily got at will save much inconvenience and additional handling when the time arrives for marketing the fruit. It is the practice of some growers to wrap the fruit when it is being packed for storage for the local market, but this is not generally recommended. It frequently happens that after a period of storage the fruit requires to be sorted before being placed on the market, and this can be done much more quickly with unwrapped fruit. It is better practice to wrap the fruit when it is taken from storage.

PLANTING.

Very careful consideration should be given to the selection of varieties for planting. The field of choice is a large one. The pioneers of the industry, by careful observation and by trying new varieties, often at considerable loss to themselves, have reduced the number of varieties that need be considered as being suitable to our requirements to under a hundred. It must ever be borne in mind that different varieties of fruit thrive better in some soils and climates than they do in others, and in making a selection the adaptability of a variety to the locality in regard to hardiness, productiveness, and the development and quality to which the fruit will attain have to be considered. The requirements of the markets for which it is intended to cater, and the carrying-qualities of the fruit, also require consideration. The fact that some varieties are inclined to be shy bearers when not closely associated with a certain other variety should not be overlooked. The planter should aim at planting a sufficient number of trees of each variety, so as to ensure a reasonable quantity of fruit of each variety being available for market purposes. The mistake of planting too many varieties should be avoided. The trees should be ordered early.

—W. K. Dallas, Orchard Instructor, Dunedin.

Citrus-culture.

The period of autumn rainfall is the most desirable season for sowing green crops in the citrus grove, to be ploughed in later. Peas, vetches, lupins, and horse-beans are all desirable crops to grow, according as to how they succeed in the locality. The most essential feature to ensure a good stand is prompt sowing coinciding with the early rains while the land is still warm. Later, when the land becomes saturated, the soil is much colder, with both germination and growth slower.

Prior to sowing, the land should be so worked as to provide a ready get-away for surplus winter rains. Unless the land is properly graded with this object, hollows may be left which, while hardly noticeable now, collect water during winter, often unnoticed among the green growth but causing much root-damage.

A dressing of ½ ton of super per acre may with advantage be worked in with the seed, but highly nitrogenous manures should be avoided at this season, as it is undesirable to force growth so late in the year, which would still be quite soft and easily damaged during even light frosts in winter.

Now is the time to cut away from the trees all lower branches or twigs to at least 18 in. clear of the ground. Clean away all refuse

from under trees, and dress the soil-surface directly under the spread of the tree with pulverized sulphate of iron, ½ lb. to the square yard. These preliminary precautions against an attack of citrus brown-rot are very necessary if full control is to be secured later, while the application of iron also does much to prevent chlorosis and maintain a healthy deep-green tone of foliage.

—W. H. Rice, Orchard Instructor, Auckland.

POULTRY-KEEPING.

MANAGEMENT OF THE PULLETS.

PROPER management of the pullets will still be the most important item in the poultry-keeper's work during the next few weeks, and the greatest care must be taken to keep them off the moult. Now that the young birds have begun to lay, or are on the point of doing so, they should be receiving a good supply of the best nourishing food. The morning mash may consist of one part by measure of good-grade wheatmeal to two parts of bran; or, where a good quality of pollard is available, two of this to one of bran. In either case the mash should be moistened with skim-milk, meat-soup, or boiling water, and mixed to a crumbly condition. Cold water will do for moistening purposes where milk or soup is not available, but by using boiling water the mash is made more appetizing and consequently will be better relished by the birds.

In order to secure a good egg-yield in winter, animal food in some form is imperative. The meat ration should, where possible, be fed by itself at a regular time—say, at midday. Where meat-substitutes have to be fed, these can be sparingly supplied in the morning mash, and increased by degrees up to 8 per cent. of the entire mixture, while, in addition, some may be placed in a separate hopper and left for the birds to pick at as they desire. If ovarian disorders occur, this indicates that the ration is of a too forcing nature and that the amount of animal food should be reduced.

Equal parts of wheat, oats, and maize make a good evening meal. When it is observed that the birds are leaving any one particular grain this should be given in a reduced quantity. The birds should be fed in the house at all times, and induced to exercise as much as possible by being compelled to scratch in dry litter for their grain ration. It is a good plan to give more food at the evening meal than the birds require; then, with the grain being fed in litter, they will have something to scratch for and keep busy in the early morning when searching for the grains left from the evening meal.

Do not fail to provide as much food as the birds will eat, for it should be remembered that an egg is one of the most concentrated and richest food products known. Obviously a hen cannot be expected to lay day after day a 2 oz. product and at the same time maintain its bodily vigour if kept in a state of semi-starvation. Further, do not forget to provide an abundance of green material, also sharp gravel-grit, crushed oyster-shell, and clean water.

LEG-WEAKNESS IN HALF-GROWN COCKERELS.

Several complaints have reached me of young cockerels losing the power of their legs. This condition is often brought about by over-feeding rich foods such as meat, meat-meal, table-scraps, milk, &c., also where insufficient exercise is provided. These influences tend to force the body of a growing bird to a degree that is beyond the strength of the undeveloped legs to carry. There is here a close analogy to the hothouse plant - a rapid development but lacking in substance. Many poultry-keepers make the mistake, after selecting the most promising cockerels for future breeding purposes, of placing them in a small coop or confined quarters. Confinement is necessary in priming birds for table use, but it is most undesirable for vigorous and healthy growth. The coddled bird during its growing stage, whether male or female, seldom or never makes an ideal breeding specimen. Plenty of fresh air and natural exercise will always be the fundamental requirements for raising vigorous stock. The modern high-type layer is a more or less artificial product, but if her kind is to be reproduced in good numbers from generation to generation the demands of nature must be observed. The higher the type of bird the greater the need to provide against the weakening influences of close confinement and lack of exercise.

On the first sign of leg-weakness all forcing-food should be eliminated from the ration. In addition, where possible, the birds should be provided with a good range, preferably on clean ground. I quite realize that all poultry-keepers do not possess conditions enabling them to provide a good range and natural exercising-space for the growing stock. In such cases the next best thing is to keep the birds busy by compelling them to scratch in deep litter for their grain food, and above all to provide an abundance of green material. In the case of the light breeds, such as Leghorns, &c., leg-weakness is often accompanied in growing cockerels with falling-over combs, a condition which is always encouraged by subjecting the birds to confinement. Especially with cockerels from which it is intended to breed, a free range suggests the best assurance of healthy development. Of course, this should go hand-in-hand with sound breeding, good feeding, comfortable housing, and efficient management generally.

TUBERCULOSIS.

Now that the adult birds are finishing up an exhaustive laying season and are on the point of moulting they are just in the condition to contract disease, especially one such as tuberculosis. It is imperative, therefore, for the birds at this time to be in as good health as possible, in order that they may have the power of resistance should they come in contact with infection. Their blood should be maintained in good order. This implies a plentiful provision of green food, clean water, and grit, while a plain but wholesome diet should be supplied. In addition, the surroundings should be as sanitary as possible. If tuberculosis makes its appearance in a flock, affected birds should be killed at once and the carcases burnt. Drastic methods of suppression are most necessary, and no time should be lost in thoroughly cleaning up the plant and removing all sources of infection, chief among which is the droppings of affected birds.

The symptoms of tuberculosis are many, but it is only the man of experience who can detect them, especially during the early stages of the disease. To the novice a wasted appearance is perhaps the plainest sign. Then the breast-bone stands out sharply from the body, and, together with the neck, becomes devoid of flesh. The comb presents a dark unhealthy appearance, diarrhœa usually accompanies the disease, and the excrement is of an unnatural colour. The bird generally limps in the right leg as the disease develops. During the latter stages it will present a listless appearance, and is disinclined to mix with the other members of the flock. When opening up a tuberculous bird the liver is usually found to be enlarged by reason of the presence of tubercle nodules scattered throughout the mass. The terms "spotted liver" and "going light" are often used to designate the condition of a bird whose liver presents this appearance. It is, however, tuberculosis and nothing else.

For this disease there is no cure; prevention is the one and only way of keeping it in check. The first step in this direction is to breed stock possessing the necessary constitutional vigour to combat the infection should a bird come into contact with it. Too much emphasis cannot be placed upon the value of plenty of fresh air in the poultry-house, while strict attention to cleanliness is of equal importance.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

WINTER STORES.

A CAREFUL examination of all hives in the apiary should now be made, in order to note the amount of honey that each possesses. It is not a good policy to winter on less than 35 lb. to 40 lb. of honey, and in the warmer parts of the Dominion it is advisable to increase this amount by half. If a colony is short of that weight and is to be wintered successfully, feeding will have to be resorted to. Just in proportion to the amount of honey that is left so will the colony thrive in the spring. If it is found necessary to feed, do so, and do not delay until the cold weather sets in. Use only inside feeders, as outside feeding is dangerous. On no account feed honey unless sure that it comes from a clean source. Using honey from a diseased hive is a certain method of infecting the apiary.

A syrup made of two parts of granulated sugar to one part of water will be found excellent for replenishing the stores when such are considered to be inadequate. The syrup is prepared by heating until there remains no trace of the sugar-granules. On no account must the mixture be allowed to boil, as this will destroy the value of the food and cause dysentery among the bees. Avoid using cheap sugars or molasses: only the best white sugar of commerce should be fed. In the absence of regular feeders, empty supers may be placed over the brood-chambers, and the syrup placed in shallow pans on top of the frames.

FOUL-BROOD.

In closing down the hives for winter the combs must be carefully examined for brood disease. Where disease is detected in a bad form do not waste time in treating, but destroy the colony. In mild cases

remove the diseased combs and insert either sheets of foundation or drawn-out combs — the latter for preference. Make a note of the infected stocks for treatment in the spring, when fine weather will enable the work to be carried out successfully. Do not tinker with diseased hives in the off season, as the trouble is more likely to spread among the clean ones by robbers.

CARE OF UTENSILS.

When extracting is finished for the year care should be taken that all traces of honey are removed from the extractor, tanks, &c. Wash carefully with boiling water, and dry thoroughly. Cleanliness should be observed as a very important matter where articles of food are concerned. Cover everything carefully from dust which may accumulate during the winter months. Loose washing-covers of close texture are the best for the purpose. Give a good coating of oil to any metal parts likely to rust: this will save much trouble in the following season.

CARE OF HIVES.

Where necessary the hives should now be given a good coating of paint. Stop up all cracks, and replace faulty hives with sound ones. Pay special attention to roofs, as it is very important that the bees should come through the winter dry. It may be necessary to cover the roofs with some waterproof material. If zinc is found too expensive, a cheap substitute, such as ruberoid, may be used. Clean all bottom-boards by scraping. The simplest plan is to provide a spare bottom-board. Lift the hive on to the spare one, scrape the old board, and replace the hive. Contract entrances against robber bees and mice, the latter pest being one for which apiarists must watch during the bees' dormant season. If these precautions are followed the colonies will be ready for winter.

—E. A. Earp, Senior Apiary Instructor.

HORTICULTURE.

HARVESTING THE MAIN CROPS.

ALTHOUGH every month is harvest-time in horticulture, the autumn has that title in a special sense, as the larger main crops then reach maturity, and many of them are of kinds which require long storage, so that they may be available over an extended period covering the winter months when fresh supplies are not so plentiful as usual. For this reason they require a special care that they do not always get. With some of the more important crops in many countries certain grades of produce are recognized in the markets when trading, and in other instances these are demanded by law. Such standard grades have many advantages, but specially does it facilitate successful storage and market transactions, thus placing the whole business on a more secure foundation. Money is more readily advanced on such stocks, so very much greater is the security.

In this direction there is room for much improvement in our methods. It is not uncommon to see large quantities of ungraded and low-graded produce incurring the expense of storage and marketing that obviously can never be financially satisfactory, and because

the practice cannot pay one expects it to be discontinued; but it still goes on, and the loss is apparently the price of experience. The least excusable practice is to mix good and bad together.

The time to grade a product is at the time of harvesting, so as to reduce handling and cartage to a minimum. By a careful consideration of the crop then it can be seen whether the main bulk is superior or good average. If the former, it can be graded and sold as such; but if there is more than 50 per cent. of the lower grade it is generally graded and sold under that class name. In any case all undersized, broken, and diseased samples must be graded out; to mix such stuff in the market grade is to lower the sample and depreciate the value much beyond any little advantage in weight. Produce in perishable condition compels a forced sale, which is a decided disadvantage to the owner. Graded produce, when given suitable storage, may be held with some confidence. It is important that the store should be clean and ample ventilation available, so that heating may be avoided, especially during the first few weeks of storage.

LAND-TREATMENT AND CROP-ROTATION.

At the other seasons of the year, as soon as one crop is harvested another is planted after a brief preparation. At the present time, with the near approach of winter months, advantage is taken to give a more thorough preparation to the land, and by dealing with different areas each winter the whole is kept in a state of fertility. The first part of the operation is to burn up the remains of the previous crop. Although if ploughed in this vegetation would form an excellent manure, too often it is affected with disease that may be readily transmitted. So frequently is this the case that the precaution of burning can rarely be omitted.

Where heavy dressings of organic manures are required and available they may be ploughed in now to advantage, or the slower-acting manures such as basic slag or blood-and-bone may be applied. Lime also may be applied now, so that its action in correcting acidity and improving the mechanical condition of the soil may be accomplished before cropping recommences. More especially does the present time afford the best opportunity for sowing a hardy green crop for ploughing under in the spring. This, as far as possible, should be of a different type from the crop immediately preceding or following it.

What treatment is given to the respective areas depends on the crops it is purposed should be planted later, and this brings one to the consideration of rotation cropping, than which nothing is more important to the grower. In the older countries centuries of experience have established in each district, according to the class of land and the crops in demand, a suitable rotation that economizes the costs of manuring, minimizes the danger of disease, and maintains the fertility of the soil. Under pressure of modern conditions, and with a virgin soil, one frequently takes the advantage to grow only the best-paying crops, which allows of little or even no rotation. But there is an end to this prodigal style of farming sooner or later, and it is a very difficult position to meet. A consistent prosperity demands that this question be studied closely in each locality and a good system of rotation arrived at.

The phase of rotation cropping being considered at present refers to vacant areas of land in market gardens at the present season and their treatment. Heavy dressings of organic manures and green crops are usually succeeded by such strong-feeding permanent crops as rhubarb and asparagus, or quicker-maturing but still gross-feeding crops as cabbage, broccoli, cauliflower, leeks, celery, and lettuce. Crops the marketable portion of which are the roots do best in a soil in which this rankness has passed off, and so usually succeed the class just mentioned. Such plants as produce fruit or seed for marketing, if grown too rankly and vigorously, defeat the end in view, as experience has proved that such a type usually flowers but sparely, and even these flowers are unlikely to set.

These statements are generalizations, and much depends on the class of soil and the rainfall of a district. The principles stand, however, and in a good rotation is to be found the most economical way of solving the expensive problems of manuring and disease and pest control.

MANAGEMENT OF TREES AND SHRUBS FROM THE NURSERY.

Where planting of this kind has to be done to any extent it is desirable to give the order the most careful consideration, and now select and order the plants required. The supply is frequently limited —in some directions, at any rate—and if the order is postponed there is a danger of having to accept substituted varieties or indifferent quality. Much better is it, considering the permanent nature of these improvements, to order early and get just what is required.

In most instances it is also desirable to take delivery as soon as the plants are available, which will probably be about the month of May, when, if the plants are growing in boxes, they should be placed together in a handy position where they can be watered when necessary and not allowed to dry out. If the plants are in bundles and have been closely packed for some time they should be opened up in a well-ventilated shed, and allowed to air and harden for twenty-four hours or so before being taken out and heeled in. This last operation is done by opening out a trench in a piece of spare ground in friable condition, and of sufficient length and size to hold the roots. Place the plants in the trench close together but not too thickly; cover the roots well with soil, and tread it rather firm. In this way the plants will keep well—all winter, if necessary—until one is ready to put them out into a permanent position.

VEGETABLE CROPS.

The winter crops of cabbage, cauliflower, celery, &c., will soon be ready for cutting. The blanching of the main celery crop should now be completed. The top growth of the asparagus crop will require to be cut down and burnt as soon as it ripens.

During the coming month, on a piece of warm, well drained and prepared land, plant out from seed-beds sown in February the early cabbage, cauliflower, and lettuce plants for spring cutting; and towards the end of the month sow further beds of these plants for putting out in the spring. These should be main-crop varieties for cutting in early summer. For this purpose the beds are better raised and sown thinly.

—W. C. Hyde, Horticulturist.

THE NEW DAIRY-PRODUCE REGULATIONS.

MANUFACTURE AND EXPORT.

(Continued from February.)

Ports and Grading-stores.

54. The ports of Auckland, Gisborne, Napier, New Plymouth, Patea, Wanganui, Wellington, Lyttelton, Timaru, Dunedin, and Bluff are hereby appointed to be the only ports at which butter or cheese may lawfully be exported.

55. The buildings specified in this clause, not including any substantial additions that may be made to such buildings after the gazetting of these regulations, unless the use of such additions has been first approved, are hereby appointed to be stores for the storage, cooling, freezing, examination, and grading of butter or cheese prior to export; that is to say, the following buildings:—

The three stores of the Auckland Farmers' Freezing Company (Limited) at Auckland, Southdown, and Horotiu; the store of the Gisborne Sheep-farmers' Frozen Meat Company (Limited) at Gisborne; the store of J. J. Niven and Co. (Limited) at Port Ahuriri; the store of the Taranaki Producers' Freezing Company (Limited) at Moturoa; the store of the West Coast Refrigerating Company (Limited) at Patea; the Wanganui Cold Storage Company's store at Castlecliff; the Wellington Harbour Board's No. 27 store at Wellington; the two stores of the Co-operative Dairy Producers' Freezing Company (Limited) at Wellington; the Lyttelton Harbour Board's cold store at Lyttelton; the store of the New Zealand Farmers' Co-operative Association (Limited) at Christchurch; the store of the New Zealand Refrigerating Company (Limited) at Smithfield; the store of the Otago Dairy Producers' Co-operative Cold Storage Company (Limited) at Dunedin; the store of the Taieri and Peninsula Milk-supply Company (Limited) at Dunedin; and the store of the Southland Cool Stores (Limited) at Bluff.

56. The ports and stores named in the last two preceding clauses are in substitution for those heretofore appointed, and every Order in Council heretofore made appointing ports or stores for the said purposes is hereby revoked.

57. The owner and person in charge of any building appointed to be a store for the storage, cooling, freezing, examination, and grading of butter or cheese prior to export shall cause the following requirements to be at all times complied with: (*a.*) The store and its appurtenances shall be maintained in an efficient state for the purposes for which it is appointed. (*b.*) All butter and cheese received into the store under the provisions of these regulations shall within a reasonable time after such receipt be reduced in temperature to the extent prescribed in subparagraph (*c*) of this clause, and shall be held at such reduced temperature until removed from the store. (*c.*) The temperature of butter or cheese at the time of delivery from the store for export shall not exceed 15 or 45 degrees Fahrenheit respectively. (*d.*) The humidity and circulation of the air in every chamber used for storing cheese shall be so controlled as to prevent excessive shrinkage in the weight of, and to prevent undue growth of mould upon, the cheese stored in such chamber.

Submitting Butter or Cheese for Grading.

58. With regard to butter or cheese for export to any country other than the Commonwealth of Australia or the South Sea Islands the following provisions shall apply: (*a.*) All butter shall, by the owner thereof, be placed in one of the appointed stores, at least four clear days before shipment, for the purpose of being graded and frozen. (*b.*) All cheese shall, by the owner thereof, be placed in one of the appointed stores, at least four clear days before shipment, for the purpose of being graded and of having the temperature reduced if necessary.

59. All butter or cheese for export to the Commonwealth of Australia or the South Sea Islands shall by the owner thereof be placed in one of the appointed stores, at least twenty-four hours before shipment, for the purpose of being graded.

60. When forwarding any butter or cheese to a grading-store as aforesaid the owner shall at the same time notify the Grader at the port of shipment, giving full particulars of the number of packages, together with their brands,

contents, and weights, and any other particulars which the Grader has asked for. Such notification shall be in, or to the effect of, form No. 12 or form No. 13 in the Schedule hereto. Forms may be purchased from the Government Printer, Wellington.

61. Every owner of butter or cheese forwarding it to an appointed store shall make his own arrangements for storage, for the transit of the produce to and from the store, and for its shipment. He shall also, in so far as he deems desirable, make his own arrangements for its insurance and protection from loss or damage of any kind.

Grading of Butter and Cheese.

62. All butter graded under these regulations shall be placed in one of the following classes, viz.: (*a*) Creamery butter, which shall include all butter manufactured at any manufacturing dairy registered as a creamery and not mixed or blended into milled butter; (*b*) whey butter, which shall include all butter manufactured at any manufacturing dairy registered as a whey-butter factory or manufactured in the manner set out in clause 35, and in either case not mixed or blended into milled butter; (*c*) dairy butter, which shall include all butter manufactured at any manufacturing dairy registered as a private dairy and not mixed or blended into milled butter; or (*d*) milled butter, which shall include all butter mixed or blended at any manufacturing dairy registered as a packing-house.

63. All cheese graded under these regulations shall be placed in one of the following classes, viz.: (*a*) Full-cream factory cheese, which shall, except as hereinafter provided, include all cheese manufactured at any manufacturing dairy registered as a factory, but shall not include any cheese which contains less than 50 per centum, by weight, of milk-fat in the dry matter or has been manufactured from milk from which any milk-fat has been removed or to which any milk-solids other than milk-fat have been added; (*b*) modified-milk cheese, which shall, except as hereinafter provided, include all cheese manufactured at any manufacturing dairy registered as a factory and which has been manufactured from milk from which some of the milk-fat has been removed or to which any milk-solids other than milk-fat have been added, but shall not include any cheese which contains less than fifty per centum, by weight, of milk-fat in the dry matter; or (*c*) dairy cheese, which shall include all cheese manufactured at any manufacturing dairy registered as a private dairy.

64. In grading creamery or whey butter the following shall be the maximum points for allotment, viz.: For flavour, 50 points; for body and texture, 25 points; for colour and salting (if any), 20 points; and for finish, 5 points: total, 100 points.

65. Creamery butter shall be graded as finest, first grade, second grade, or third grade according to the following standards:—

Finest	93 points and over.
First grade	90 points and under 93 points.
Second grade	80 points and under 90 points.
Third grade	Under 80 points.

66. Whey butter shall be graded as first grade, second grade, or third grade according to the following standards:—

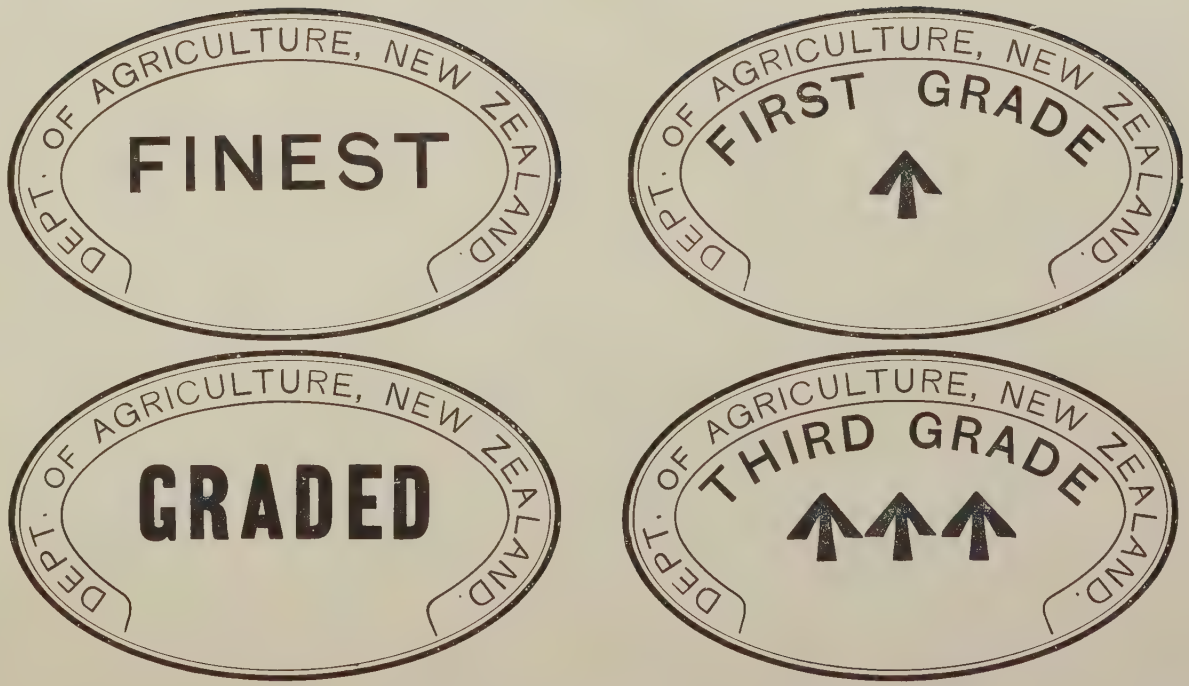
First grade	88 points and over.
Second grade	80 points and under 88 points.
Third grade	Under 80 points.

67. Dairy or milled butter shall be graded as first grade, second grade, or third grade according to quality and condition.

68. In grading factory cheese the following shall be the maximum points for allotment, viz.: For flavour, 50 points; for body and texture, 30 points; for colour, 15 points; and for finish, 5 points: total, 100 points.

69. Full-cream factory cheese shall be graded as finest, first grade, second grade, or third grade according to the following standard:—

Finest	93 points and over.
First grade	90 points and under 93 points.
Second grade	80 points and under 90 points.
Third grade	Under 80 points.



FORMS 14 TO 17, REGULATION 72: GRADE STAMPS.

The stamp "Graded," in lower left corner, is for second-grade butter and cheese.

70. Modified-milk cheese or dairy cheese shall be graded as first grade, second grade, or third grade according to quality and condition:

Provided that in grading modified-milk cheese or dairy cheese the Grader may, at his discretion, allot points in the manner provided by Regulation 68 hereof, and thereupon grade the cheese according to the standards set out in clause 69 hereof, save that the term "finest" shall not be used, and the term "first grade" shall be used for cheese graded as of 90 points and over.

71. (1.) In grading butter or cheese the Grader shall allot the grade upon examining, in the case of butter, one box from each churning and such further number of boxes as he deems necessary, and, in the case of cheese, one cheese from each vat and such further number of cheeses as he deems necessary.

(2.) The decision of any Grader as to the grade of any butter or cheese shall be conclusive, and no action or other proceeding shall lie against the Crown, or against any Grader, or against any other officer of the Crown, in respect of any erroneous decision of a Grader as to such grade.

72. As soon as possible after grading any butter or cheese the Grader shall stamp or cause to be stamped each package with a grade-mark in such one of the forms 14 to 17 in the Schedule hereto as is appropriate to the grade of such butter or cheese as determined in accordance with clauses 62 to 70 hereof.

73. The Grader shall also as soon as possible send to the owner of the butter or cheese a certificate of the said grade (hereinafter called a "Grader's certificate") in such one of the forms 18 to 24 in the Schedule hereto as is appropriate to the said grade.

74. Notwithstanding the provisions of clauses 72 and 73 hereof, no grade-mark shall be applied in respect of any butter which contains more than 16 per centum, by weight, of water, or less than 80 per centum, by weight, of butterfat, or in respect of any cheese of which the water-free substance consists of less than 50 per centum, by weight, of fats wholly derived from milk; nor shall any Grader's certificate be issued in respect of any such butter or cheese.

75. No person shall remove from an appointed grading-store, except for the purpose of immediately shipping it for export beyond New Zealand, any butter or cheese in respect of which a grade-mark has been applied, unless the grade-mark has been cancelled by a stamp bearing the words "Not for export."

76. No person shall export, or attempt to export, or be concerned in exporting, any butter or cheese unless it has the grade-mark stamped on the package and uncancelled, and is otherwise in accordance with the provisions of these regulations.

77. Any person who knowingly and wilfully represents or implies for any purpose whatsoever that the Grader's certificate issued in respect of any lot of butter or cheese is the certificate issued in respect of any other lot of butter or cheese commits a breach of these regulations.

78. In respect of fees for grading butter and cheese the following provisions shall apply: (*a.*) The fee for grading butter shall be 1·24d. per standard box, subject as hereinafter provided. (*b.*) The fee for grading cheese shall be 1·65d. per standard crate, subject as hereinafter provided. (*c.*) (i.) In the case of butter or cheese forwarded for export from a registered creamery, factory, whey-butter factory, or private dairy the fee shall be payable by the manufacturer on demand. (ii.) In the case of butter or cheese not included in (i) the fee shall be payable by the owner on demand. (*d.*) Where it is found that the total amount paid or payable in respect of grading fees in any year ending on the 31st day of March exceeds the cost, as determined by the Minister, of the dairy-produce-grading service, including the salary and expenses of the Government Dairy-produce Officer or Officers in London, the Minister may credit to the payers of fees, towards the fees payable by them during the next succeeding year, the amount paid or payable in excess of such cost as aforesaid, in the proportion in which each payer contributed towards the fees paid or payable during the period in question. (*e.*) Where it is found that the total amount paid or payable as aforesaid is less than the cost of the said service determined as aforesaid, the amount of such deficiency shall be deemed to be part of the cost of the said service in respect of the next succeeding year.

79. (1.) Butter or cheese shall be regraded—(*a*) If the owner makes a request to the Director to that effect and it is practicable for the Director to arrange for it to be complied with; or (*b*) if the Director is of opinion that the quality of the produce is likely to have changed since the previous grading thereof; or (*c*) if the

owner has removed the produce from the appointed grading-store and the produce is again forwarded for grading or shipment.

(2.) If upon regrading it is found that the grade should be altered, the Grader shall remove or cause to be removed the existing grade-marks, and shall mark or cause to be marked the package in accordance with the grade as altered; the original Grader's certificate shall be returned to the Grader to be cancelled, and the Grader shall issue a fresh certificate in accordance with the regrading.

(3.) In any case where regrading is undertaken at the instance of the Director and the grade remains unchanged no charge shall be made for the regrading or relative expenses, but in every other case of regrading the ordinary grading fees, together with any relative expenses, shall be payable by the owner in respect of each regrading.

(To be concluded.)

WEATHER RECORDS: FEBRUARY, 1927.

Dominion Meteorological Office.

GENERAL SUMMARY.

RAINFALL in February was above the average in most parts of Otago and the west-coast and northern parts of the North Island, but was deficient elsewhere. The backwardness of the early summer season was compensated for by the intensity of its later part in most districts.

The heat wave which came on about the middle of January continued until the third week in February, and some very high temperatures were recorded, particularly on the 7th, 13th, and 14th, in the east-coast districts of both Islands.

A westerly area of low pressure of moderate intensity ruled at the beginning of the month, and several minor disturbances passed south of the Dominion. One on the 22nd was followed by a cold snap, and a short but rather severe storm with a southerly gale prevailed on the 27th.

Electrical conditions were in evidence in many parts of the country about the 1st, 10th and 11th, and 26th and 27th.

During the month investigations of the upper-air currents were made at the Wigram Aerodrome, Christchurch. The ascents of twenty-one pilot balloons were followed, and records telegraphed to Wellington. Preliminary examination of these results show that although winds were from all directions at the surface, above 6,000 ft. of elevation they were from the west, and afterwards attained their greatest velocity. On one occasion the balloon was followed up to a height of 55,000 ft., while on two occasions they were lost in clouds at 3,000 ft.

RAINFALL FOR FEBRUARY, 1927, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average February Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	5·18	7	1·92	2·95
Russell	4·62	8	1·46	3·33
Whangarei	4·68	12	1·14	4·85
Auckland	5·58	10	2·02	3·06
Hamilton	5·10	12	1·12	2·96
Kawhia	5·38	12	0·85	2·40
New Plymouth	4·05	10	1·29	4·01
Riversdale, Inglewood	7·01	10	2·02	6·30
Whangamomona	6·23	11	1·42	4·14
Tairua	4·64	8	1·98	4·52
Tauranga	3·63	9	1·93	3·58

RAINFALL FOR FEBRUARY, 1927—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average February Rainfall.
North Island—continued.				
	Inches.		Inches.	Inches.
Maraehako Station, Opotiki ..	6·22	11	2·12	3·48
Gisborne	4·59	10	1·23	3·63
Taupo	4·70	6	1·60	2·81
Napier	1·00	11	0·21	2·92
Maraekakaho Station, Hastings ..	1·49	9	0·71	2·52
Taihape	3·17	13	1·08	2·52
Masterton	1·58	10	0·41	2·70
Patea	2·44	12	0·71	2·33
Wanganui	0·63	4	0·28	2·49
Foxton	4·72	7	1·90	2·06
Wellington	1·82	7	0·91	3·19
South Island.				
Westport	0·87	11	0·20	4·37
Greymouth	2·73	10	0·57	6·13
Hokitika	3·04	9	0·86	7·31
Ross	3·13	7	0·81	8·45
Arthur's Pass	6·23	9	2·83	10·17
Okuru, Westland	7·94	10	2·28	7·92
Collingwood	3·67	10	1·41	5·63
Nelson	1·38	8	0·49	2·77
Spring Creek, Blenheim	1·80	8	0·60	2·30
Tophouse	1·58	6	0·65	4·39
Hanmer Springs	2·20	6	0·73	2·93
Highfield, Waiau	2·07	5	0·74	2·59
Gore Bay	1·66	6	0·70	3·50
Christchurch	0·80	7	0·37	1·77
Timaru	1·34	12	0·30	1·82
Lambrook Station, Fairlie ..	2·23	10	1·03	1·95
Benmore Station, Clearburn ..	1·68	5	1·22	1·23
Oamaru	1·89	7	0·65	1·68
Queenstown	1·75	7	0·70	1·76
Clyde	1·22	6	0·74	0·99
Dunedin	3·19	12	1·22	2·69
Wendon	2·52	6	1·00	1·57
Gore	2·46	8	0·80	2·56
Invercargill	3·44	15	0·66	2·85
Puysegur Point	7·94	16	2·12	4·96

—*D. C. Bates, Director.*

DETERIORATION OF WOOL.

INFORMATION placed before the Board of Agriculture at its last meeting indicated clearly that deterioration was taking place in some of the wool grown in New Zealand. Two contributing factors appeared to be the use of inferior rams and a tendency to dispose of the best ewe lambs as fat stock. It was resolved to bring the matter under the notice of the various breed societies, and to suggest (*a*) that stud flocks be more rigidly inspected, and (*b*) that no cull rams (among Flock-book sheep) be allowed to be sold for breeding purposes. It was further resolved to request the Department of Agriculture to instruct its Inspectors to make special efforts to induce farmers to retain their best ewe lambs for breeding purposes.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

CONTROL OF RAGWORT.

"RAGWORT," Opotiki :—

Can you recommend a treatment to destroy a few patches of ragwort? We have been pulling these patches for the last three years before they have time to seed, placing the plants on rubbish such as logs, &c., and burning same. The trouble seems to be that the smallest fibre root left in the ground sprouts the following season.

The Live-stock Division (Noxious-weeds Inspection) :—

The question may be treated under three categories : (1) Ordinary sheep-country ; (2) land used for mixed grazing ; (3) land used exclusively for dairying purposes. For class 1 (sheep-country) we would recommend, after pulling the plants, a liberal top-dressing of the infested ground with basic super and kainit in the proportion of 4 cwt. and 1 cwt. respectively per acre. This will attract the sheep on to the ragwort patches, and they generally bring about the desired result in a couple of seasons. Ewes attack ragwort much more readily than do wethers or young sheep. Small patches aggregating an acre in a field of 50 acres or more of reasonably good pasture should not produce any serious disability to sheep depastured thereon. For class 2 (land used for mixed grazing) top-dress as for sheep-country, and if the proportion of cattle carried is greater than sheep it might be desirable to fence in the infested part in such a way that the sheep (preferably ewes) are more closely confined on the affected area. Sheep used in this way for the eradication of ragwort should be moved frequently—say, after three weeks—on to clean pasture for a similar period, when they can again be returned for a further term on the ragwort. As regards class 3, if the better-class lands are to be preserved for dairying purposes ragwort must not be allowed a place in the pastures. In the earlier stages of infestation, when the weed is confined to small patches, the matter of cultivation is worthy of consideration. In such cases it is a good plan to reverse the common practice of pulling or digging out by digging in. It will be found that this plant readily succumbs to cultivation. The surface roots, which frequently survive the pulling or digging out process, will cease to give further trouble if ploughed or dug in to a depth of 6 in. Further, the seed will not germinate if covered to a depth of 2 in. or 3 in. If odd plants and small patches of ragwort are treated with due respect and destroyed early it will save the farmer a great deal of worry and expense later.

OUTDOOR STORAGE OF APPLES.

G. H. LONEY, Wellington :—

Kindly let me know whether apples can be pitted successfully in New Zealand for keeping purposes, and, if so, the best method to adopt ; also what varieties are recommended for storing in this way.

The Horticulture Division :—

Apples cannot be pitted successfully in the usual way, as, although they keep fairly well under that treatment, the flavour is badly affected. An approximate method that is somewhat better is to make a bin in a plantation of evergreen trees or other shady place by driving in stakes and boarding up the sides or building them up with brushwood, and filling the bin with sound fruit to a height of not more than about 2 ft. or 3 ft. Pile the centre and make what protection may be necessary. Only what are known to be keeping varieties should be stored in this way, and, as any broken or decayed fruit mixed in will cause loss, success depends on only sound fruit being stored.

WIREWORMS AND THEIR CONTROL.

R., Rotorua :—

Could you please give me a brief life-history of the wireworm? What crops does it chiefly attack, and is there any way of destroying the pest—say, by a soil-fumigant?

The Fields Division :—

There are several species of wireworms, many of which are restricted in their range. The life-histories of these have not been worked out in detail in New Zealand. The following account refers in a general way to wireworms as a whole: Wireworms are the larvæ of click-beetles (Elateridae). Those species whose larvæ live underground lay their eggs under the surface of the soil about the roots of grasses. This is done by several of the species in the spring. The larvæ, on hatching, feed on roots, and may take from two to three years to fully grow when they pupate. The pupal period lasts several months. The adult click-beetles emerge from the pupæ. All pasture carries a normal wireworm population. When old-standing pasture is broken up and a crop sown—for example, cereals or potatoes—the wireworms will attack and may do some considerable damage for the first season, but the infestation diminishes considerably the longer the ground is under cultivation. Beyond thorough cultivation control is unsatisfactory. Soil-fumigation may do a little good, and the use of calcium cyanide worked into the ground during cultivation at the rate of 200 lb. to the acre has been said to have good effect. The cyanide applications should be made not later than fourteen days before a crop is sown. This treatment is practicable for comparatively small areas only.

WIND-GALL IN HORSE'S FETLOCK.

E. E. DENHAM, Auckland :—

I have a horse with a wind-gall at the fetlock. The swelling is a large one (more than half the size of a closed fist), and extends through to other side of leg. The wind-gall has been there for about three months, and may be an old trouble. The horse is lame to some extent, and the swelling hard when the animal has his weight on that leg. Will the fluid have to be drawn off, and, if that is done, will the relief be permanent?

The Live-stock Division :—

The usual treatment for severe chronic wind-galls consists of blistering the parts and, later, when the immediate effects of the blister have subsided, keeping the fetlock bandaged with dry flannel bandages. If this shows no beneficial effect within the course of two months, the only treatment likely to do good would be the evacuation of the fluid. This operation will not afford permanent relief or be likely to do any good unless performed by a skilled man, because the gall will rapidly fill up again, and unless extreme care is taken the parts will become septic, thus probably rendering the horse quite useless. As in the case of your horse the wind-gall appears to be a very large one and to be causing lameness, a good long rest would be needed after any treatment. This certainly seems to be a case for examination and treatment by a veterinary surgeon, who would be able to deal with the trouble according to its merits.

ITALIAN BEES AND SECTION HONEY.

"APIARIST," Brydone :—

Please inform me how to work sections for honey with Italian bees. I have had no trouble with Black bees, but I cannot get the Italians to start the sections.

The Horticulture Division :—

Italian bees may be induced to enter the section boxes by first adding a super of half-depth extracting-combs. The bees will enter these more readily, and get the habit of storing above. When the extracting-combs are well started, raise them and place the section boxes immediately over the brood-chamber.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 31st December, 1926, to 24th February, 1927, include the following of agricultural interest :—

No. 54485 : Cheese product ; A. G. W. Cutter and F. J. Schwieters, Kaponga. No. 54750 : Butter-box ; J. Brennan, Brisbane, Queensland. No. 54814 : Ploughshare : J. McRae, Springburn. No. 55659 : Fruit-grader ; W. McBirney, Rarotonga. No. 55762 : Milking-machine attachment ; J. H. Mason, Feilding. No. 56760 : Coulter-buckle ; P. and D. Duncan, Ltd., Christchurch. No. 56830 : Manure-distributor ; F. T. F. Evans, Auckland. No. 57249 : Fencing-post ; H. L. Schaeffer, Eskdale. No. 57420 : Sheep-shear flexible coupling ; J. Davidson, Sydney, N.S.W. No. 55557 : Butter-tray ; L. Malaghan, Dunedin. No. 55825 : Incubator ; C. T. Price, Dunedin. No. 57466 : Sheep-shears friction-drive ; J. Davidson, Sydney, N.S.W. No. 57575 : Manure-distributor marker attachment ; F. T. F. Evans, Auckland. No. 57623 : Tripod harrow ; F. T. F. Evans, Auckland. No. 55433 : Dressing flax ; F. V. Raymond, Auckland. No. 55761 : Milking-machine valve ; J. H. Mason, Feilding. No. 57621 : Harvesting-machine ; W. Mitchell, East St. Kilda, Victoria. No. 55630 : Scutching-machine ; M. H. Wynyard, Onehunga. No. 56950 : Ploughshare ; W. Mackay, South Yarra, Victoria. No. 57767 : Wool-pack ; J. O. Viney, Melbourne. No. 57827 : Destruction of pests ; Hart and Co. Proprietary, Ltd., Melbourne.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington, price 1s. All fees must be paid in advance in cash, or paid to the Public Account at a branch of the Bank of New Zealand and the bank receipt sent to the Patent Office ; or fees may be remitted by Post Office order or postal note.

FARM MACHINERY IN NEW ZEALAND.

THE particulars tabulated below are compiled by the Census and Statistics Office. It will be noticed that electric motors and agricultural tractors have both almost doubled in 1926 as compared with 1925. In 1921 the number of electric motors returned was only 456.

——	1925.	1926.	——	1925.	1926.
Farm Engines.			*Farm Machinery and Implements.*		
Water-power—			Reapers-and-binders ..	15,881	15,574
Number of wheels or motors	846	967	Threshing-machines ..	477	361
Approximate horse-power * ..	3,325	3,614	Chaffcutters	2,903	2,865
Electric—			Wool-presses	8,601	8,641
Number of motors ..	3,451	6,356	Cream-separators	44,656	45,765
Nominal horse-power ..	7,235	12,631	Milking-plants—		
Steam—			Number of plants ..	15,561	16,391
Number of engines ..	622	473	Number of cows capable of being milked simultaneously	56,226	58,648
Nominal horse-power ..	2,975	2,221			
Internal combustion—					
Number of engines ..	19,894	19,434	Total number of cows milked on 31st January	705,033	729,772
Nominal horse-power ..	62,794	61,706			
Portable or traction—			Shearing-machines—		
Number of engines ..	854	832	Number of plants ..	5,728	5,949
Nominal horse-power ..	5,427	5,456	Number of stands ..	18,445	18,797
Agricultural tractors—					
Number of tractors ..	1,026	2,025			
Nominal horse-power ..	17,222	32,360			

* Being aggregate power of cases where specified.

FORTHCOMING AGRICULTURAL SHOWS.

Rotorua A. and P. Association : Rotorua, 23rd March.
Methven A. and P. Association : Methven, 31st March.
Temuka and Geraldine A. and P. Association : Geraldine, 31st March.
Malvern A. and P. Association : Sheffield, 21st April.
Flaxbourne A. and P. Association : Ward, 27th April.